VEHICLE ENGINEERING

AGENDA

Presenter:	
Organization/Date: Orbiter/05-16-02	

BOEING RELOCATION STATUS	**To Be Presented**
ORBITER	**To Be Presented**
SOFTWARE	**No Constraints**
FCE	**No Constraints**
GFE	**To Be Presented**
FLIGHT READINESS STATEMENT	**To Be Presented**
BACKUP INFORMATION	

Orbiter and Flight Software

Boeing Relocation Status

MV/Ralph R. Roe, Jr.

Boeing Orbiter and FSW Relocation Status

	Total	Captured (Existing/Moving)	Replacements Required	Replacements Filled	Incumbents Lost (Boeing/HSF&E)
SSM's	61	12/3	46	45	0/18
OVE Mgmt	13	0/4	9	2	0/0
Orbiter Critical Skills	89	35/10	44	23	1/6
FSW Critical Skills	97	9/16	72	36	5/17
Total	260	56/33	171	106	7/46

Orbiter STS-111 CoFR

- **Orbiter Critical Skills Transition Process has been assessed for impacts to the near term COFR process**

STS-111	STS-107	STS-112	STS-113	STS-114

Green: Certified (SSMs)/Qualified (Critical Skills) personnel producing flight products

Yellow: Replacement personnel generating flight products with approved work around plan in place

Red: Critical skills unavailable

- **STS-111 is yellow because interim/acting SSM's are delivering flight products in the following subsystems:**
  - **EPD&C (H/W), Mass Properties, GN&C Ascent Analysis , KU-Band, EPD&C (Sys), Payloads Accomodations, EPD&C (MEC, EMEC, BFC, GCIL), Hydraulics/WSB, Comm & Track (Antennas, Coax), Comm & Track (Audio Sys.), G&N - Star Tracker, Data Processing Sys. (MCDS), Panels & Components, DPS (MDM), Crew Module, Crew Transfer Structural Subsystems**
- **USA oversight in each of these areas has been defined**
- **NASA oversight in each of these areas has been defined**

Flight Software STS-111 CoFR

- **Flight Software Critical Skills Transition process has been assessed for impacts to the near term COFR process**

STS-111	STS-107	STS-112	STS-113	STS-114

Green: Qualified personnel producing flight products

Yellow: Replacement personnel generating flight products with approved work around plan in place (if required)

Red: Critical skills unavailable

- **With expected hiring, training and qualification schedules, flights through STS-113 are anticipated to use at least some interim / replacement personnel to produce flight products**
  - **Plan developed to track interim PFO / ILO selections**
  - **Replacement process for final PFO / ILOs has also been defined**
    - **SASCB approval is required for replacement owners**

STS-111
FLIGHT READINESS REVIEW

May 16, 2002
Orbiter

AGENDA

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

- Engineering Readiness Assessment
  - Previous Flight Anomalies — To Be Presented
  - Critical Process Changes — To Be Presented
  - Engineering Requirement Changes — No Constraints
  - Configuration Changes and Certification Status — To Be Presented
  - Mission Kits — No Constraints
  - Safety, Reliability and Quality Assessment — No Constraints
- Special Topic — To Be Presented
  - Previous FRR Topics Update

	Presenter:
	Organization/Date: Orbiter/05-16-02

PREVIOUS FLIGHT ANOMALIES

	Presenter:
	Organization/Date: Orbiter/05-16-02

STS-110
IN-FLIGHT ANOMALIES

PREVIOUS IN-FLIGHT ANOMALIES

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

STS-110 In-Flight Anomalies, Previous Shuttle Mission:

- Three Orbiter in-flight anomalies identified:
  - STS-110-V-01: Primary RCS Thruster L1A Failed Off
  - STS-110-V-02: Primary RCS Thruster F1D Low Chamber Pressure
  - STS-110-V-03: Primary RCS Thruster F3L Low Chamber Pressure
    - Details of above presented on following pages
  - STS-110-V-04: MEDS IDP2 MSU BITE & FCW Buffer Overflow Error
    - MEDS not installed in OV-105

All Anomalies and Funnies Have been reviewed and None Constrain STS-111 Flight

STS-110 RCS THRUSTER FAILURES

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Observation:

- Three RCS thruster anomalies occurred during the STS-110 mission
  - Thruster L1A failed off during NC3 burn
  - Thruster F1D had several low chamber pressure pulses during rendezvous ops
  - Thruster F3L experienced two low chamber pressure pulses during post-undocking ISS flyaround

Concern:

- Loss of RCS thruster redundancy
- Unknown worst case consequence of continued operation of thruster with low chamber pressure

STS-110 RCS THRUSTER FAILURES

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Discussion:

- L1A (S/N 215) failed off during first commanded firing
  - Chamber pressure (Pc) reached max value of 20 psia which resulted in deselection by RM
  - Fuel and ox flow was evident by drop in injector temps
  - Low Pc and injector temp drops indicate partial flow on one valve (full flow on the other)
  - Fifth flight of this thruster since last installation/flushing
  - Most likely cause is fuel valve seal extrusion
    - Fuel valve failed initial GN2 response test during last repair/flush cycle at WSTF
    - Retested in-spec and delivered to KSC
  - Thruster was deselected for remainder of mission

STS-110 RCS THRUSTER FAILURES	Presenter: Doug White
	Organization/Date: Orbiter/05-16-02

Discussion: (cont)

- F1D (S/N 484) experienced three consecutive pulses with low Pc (63-65 psia) during rendezvous ops
  - 7th firing (of 11 total) of the mission also had low Pc
  - Thruster was not deselected by RM since Pc > 26 psia
  - All four pulses were minimum impulse (80 msec duration)
  - All other firings (all >80 msec) exhibited nominal Pc
- Review of vehicle rate data indicates that firings with low Pc resulted in decreased thrust level for those firings (~40-60% of expected)
- Fuel and ox flow was evident by drop in injector temps
- 5th flight of this thruster since last installation/flushing
  - Ox and fuel valves have 16 total flights
- Thruster was deselected for nominal undock with an option to reselect for contingency undock ops

STS-110 RCS THRUSTER FAILURES	Presenter: Doug White
	Organization/Date: Orbiter/05-16-02

Discussion: (cont)

- F3L (S/N 411) experienced two 80 ms pulses with low Pc of 65 and 69 psia during post-undocking ISS flyaround
  - Thruster was not deselected by RM since Pc > 26 psia
- F3L was placed in last priority and ultimately deselected for the remainder of the mission
- Previous performance of the thruster during the mission (78 firings) showed nominal performance
  - 61 of 78 were 80 ms pulses
- Review of vehicle rate data indicates that firings with low Pc resulted in decreased thrust level for those firings (~40-60% of expected)
- Fuel and ox flow was evident by drop in injector temps
- 5th flight of this thruster since last installation/flushing
  - Ox and fuel valves have 18 and 5 total flights respectively

STS-110 RCS THRUSTER FAILURES	Presenter: Doug White
	Organization/Date: Orbiter/05-16-02

Actions Taken:

- Fault tree evaluation identified sluggish valve as most likely cause of the two low Pc anomalies
  - Failure mode outside of historical database
  - Previous testing of valve mismatch up to 40 ms showed no problems with thruster
  - Unknown effect with degraded valve mismatch
    - Worst case scenario is for ox vapor to migrate into fuel injector holes for fuel valve lag
    - Reaction in injector could occur when fuel valve opens
  - Valve mismatches up to 280 ms would not result in RM deselection of the thruster
- Valve mismatch test performed at WSTF
  - Determine effect of increasing valve lag time > 40 ms
  - Determine sufficiency of RM to protect for sluggish valves
  - Establish Pc vs. lag baseline – correlate to flight data

STS-110 RCS THRUSTER FAILURES	Presenter: Doug White
	Organization/Date: Orbiter/05-16-02

Actions Taken: (cont)

- Valve mismatch test showed no detrimental effect to thruster
  - Varied lag time from 40 ms to 280 ms on fuel and ox valves for 80 and 320 ms pulses
  - Monitored several test parameters to determine if any reactions in injector occurred (Pc, manf. pressures, valve accels. and injector temps)
    - Nominal thruster performance seen on each pulse other than expected start-up delay
    - No manifold or Pc spikes seen and no leakage occurred on either fuel or ox valves
  - Additional tests performed with increased lag times for an 80 ms pulse to attempt to duplicate low Pc condition
    - Low Pc indications (~40 – 80 psia) seen with 60 ms lag
- Concluded that valve mismatch up to 280 ms does not result in thruster damage
  - RM sufficient to deselect thruster for lags > 280 ms

STS-110 RCS THRUSTER FAILURES

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Actions Taken: (cont)

- Reviewed Zot test results to determine possibility of a sluggish valve causing a Zot reaction
  - A Zot is an explosive reaction that occurs when one propellant condenses in the injector flow passages of the other propellant between thruster firings
    - Reaction in injector manifold could cause valve seat damage and gross leakage
    - Some leakage seen during tests after repeated Zots
  - Zots are only a concern at lower altitudes and with a cold injector
  - SODB constraints in-place to preclude Zot occurrences
    - Heater usage reduces Zot concern
    - Worst case effect with heater loss is valve leakage
  - Conditions that existed during low Pc anomalies were not sufficient to cause a Zot
    - Orbit altitude, operational heaters, suspected valve lag

STS-110 RCS THRUSTER FAILURES	Presenter: Doug White
	Organization/Date: Orbiter/05-16-02

Actions Taken: (cont)

- Reviewed history of OV-105 thrusters
  - 7 of 38 thrusters replaced this flow due to STS-108 R&Rs
  - No evidence of performance problems on any OV-105 thruster currently installed during last GN2 response test at WSTF

Actions In Work / Planned:

- Post-flight inspection of F1D revealed excessive “soot” in chamber and on boundary layer cooling (BLC) holes
  - Sample analysis performed at the MAB lab with analytical methods and results coordinated with WSTF
  - High amounts of silicon and oxygen found; source under investigation
  - Additional analysis to be performed on this material from injector when thruster arrives at WSTF

STS-110 RCS THRUSTER FAILURES	Presenter: Doug White
	Organization/Date: Orbiter/05-16-02

Actions In Work / Planned: (cont)

- Thrusters L1A, F1D and F3L will be removed and replaced
  - Requires entire manifold R&R to prevent sympathetic failures
  - F1D & F3L / fwd manifolds 1 and 3 (4 thrusters per manifold) – planned removal ~5-24-02
  - L1A / left manifold 1 (3 thrusters) – planned removal ~ 6-10-02
- Failed thrusters will be sent to WSTF for TT&E
  - Failure analysis on these and other recently failed thrusters will be expedited to determine cause(s) and correlations
    - TT&E will isolate problem to either the fuel or ox valve
- Analyze propellant samples from OV-104 RCS manifolds/tanks

STS-110 RCS THRUSTER FAILURES

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Actions In Work / Planned: (cont)

- Due to recent increase in thruster failures (6 in the last 3 missions) a team has been formed to re-evaluate thruster processing at WSTF and KSC and current failure risk mitigation procedures
  - Valve/thruster build-up
  - Acceptance testing
  - KSC installation/checkout
  - Risk mitigation processes
    - GN2 purge, flushing, throat plugs
  - Flight usage/changes
  - Correlate failures with flight history/processing
- Preliminary schedule of team activities:
  - Initial core team meeting to review data and define activities and milestones leading up to TIM: 5-13-15/02
  - Full team TIM: mid-June, 2002
    - Establish schedule for period progress reporting and target completion date for recommendations

STS-110 RCS THRUSTER FAILURES

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Risk Assessment:

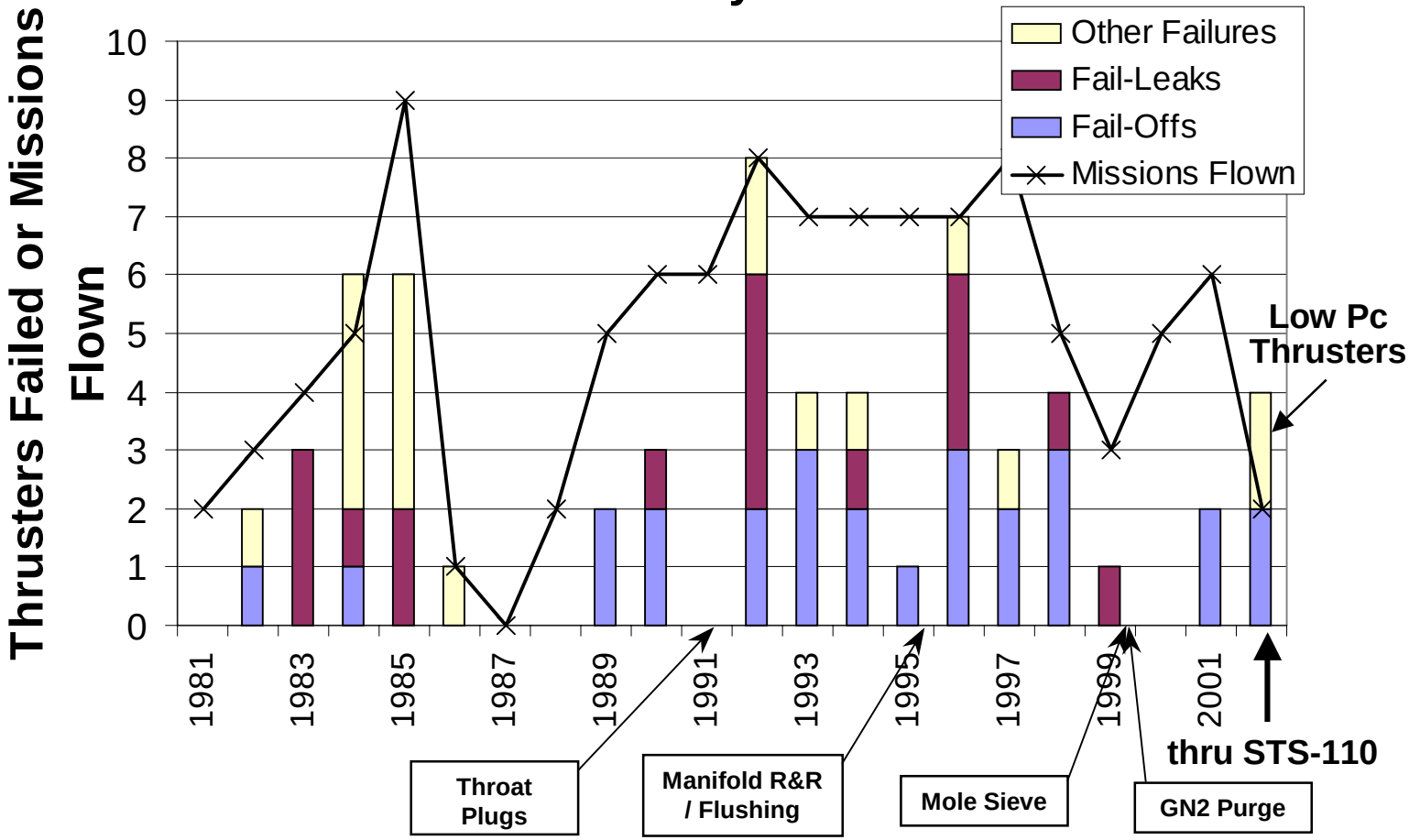
- Failed off/leak thruster is Crit 1R/3
  - Redundant thrusters exist in all firing directions
- No adverse impact of thruster utilization with low Pc due to sluggish valve
  - Valve mismatch tests showed most likely cause (sluggish valve) does not result in hardware damage
  - RM is sufficient to deselect thruster with worst case valve mismatch
  - Flight rules require thruster with low Pc to be put in last priority - will only be used if other thrusters fail
- Risk mitigation actions are in place to reduce failures
  - Preventative maintenance flushing performed on all primary thrusters at OMM, as well as those used for in-flow replacements
  - Full manifold R&R required for any thruster removal to preclude collateral damage
  - GN2 chamber purge implemented during turnaround operations to reduce propellant vapor build-up
  - Molecular sieve of oxidizer implemented at KSC

STS-110 RCS THRUSTER FAILURES

Presenter:
Doug White

Organization/Date:
Orbiter/05-16-02

Shuttle Orbiter RCS Thruster In-Flight Failure History



STS-110 RCS THRUSTER FAILURES

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Acceptable for STS-111 Flight:

- No history of marginal performance on any OV-105 thruster during last GN2 response test at WSTF
- WSTF test data showed no adverse impact of thruster utilization with low Pc caused by sluggish valve operation
  - RM is sufficient to deselect thruster with valve lags beyond the test database
- Conditions on STS-110 low Pc anomalies would not create a Zot
  - SODB constraints in-place to preclude Zot occurrences
- Redundant thrusters exist for each firing direction
- Flight rules exist for failed off thrusters
- Not a safety-of-flight issue
- Risk-mitigation actions in place to reduce failures

	Presenter:
	Organization/Date: Orbiter/05-16-02

STS-108
IN-FLIGHT ANOMALIES

PREVIOUS IN-FLIGHT ANOMALIES

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

STS-108 In-Flight Anomalies, Previous OV-105 Mission:

- Four Orbiter in-flight anomalies identified:
  - STS-108-V-01: RCS Thruster R4U Failed Off
    - Thruster R & R'd
  - STS-108-V-02: RCS Thruster F3F Failed Off
    - Thruster R & R'd
  - STS-108-V-03: IMU-2 Z-Axis Redundant Rate Anomaly
    - IMU R & R'd
  - STS-108-V-04: FES Secondary Controller Anomaly
    - Faulty temp sensor R & R'd and repacked
  - Details in backup

All Anomalies and Funnies Have Been Reviewed and None Constrain STS-111 Flight

	Presenter:
	Organization/Date: Orbiter/05-16-02

CRITICAL PROCESS CHANGES

STS-111 CRITICAL PROCESS CHANGE REVIEW SUMMARY

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Item Reviewed	No. of Items Reviewed	Period or Effectivity Covered	No. Found To Be Critical Process Changes
OMRSD Changes (RCNs)	15	STS-111 Specific & Non-Flight Specific Changes Approved 2/19/02 – 4/8/02	0
OMRSD Waivers & Exceptions	4	STS-111 Specific	0
IDMRD Changes (MCNs)	1	Approved 2/19/02 – 4/8/02	0
IDMRD Waivers & Exceptions	3	Approved 2/19/02 – 4/8/02	0
EDCPs	18	Closed 2/19/02 – 4/8/02	1
Boeing Specifications	36	Released 2/19/02 – 4/8/02	6
Boeing Drawings	195	Released 2/19/02 – 4/8/02	0
Material Review	176	Approved 2/19/02 – 4/8/02	0

- All process changes were reviewed and none constrain STS-111

CRITICAL PROCESS CHANGES

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

EDCP ORB-0134, Fuel Cell Powerplant Unitized Electrode Assembly Alternate Part

- This EDCP incorporates the P/N FC4249-01 unitized electrode assembly developed for the long life fuel cell into the current baseline fuel cell powerplant configuration as an alternate part.
- The vendor has initiated production of flight quality unitized electrode assembly in anticipation of long life alkaline fuel cell production.
- Unitized electrode assembly operating life is primarily limited by corrosion. The new unitized electrode assembly incorporates improvements in corrosion tolerance and have successfully completed 5000 hours on endurance testing.

CRITICAL PROCESS CHANGES

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Boeing Specifications:

MA0101-308 Rev L, Installation of Captive Fasteners

- This process specification was updated to reduce the torque requirement for installation of ME114-0025 captive nuts to reduce potential damage to hardware
- M&P Engineering has verified that the lower torque is still acceptable for preload requirements.

MB0135-087 Rev B, Tape, Polyimide, Flame Resistant

- This material specification was updated to remove an out-gassing test requirement.
- Orbiter requirements for tape out-gassing are controlled via M&P MATCO requirements
  - Tape is procured only from vendors who are placed on a qualified source list (QSL) after demonstrating capability of meeting the M&P MATCO requirements

CRITICAL PROCESS CHANGES

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Boeing Specifications:

Orbiter Electrical System Procedures -

ML0603-0001 Standard Maintenance

ML0603-0002 Engineering Standard Maintenance

ML0603-0003 Material Review Maintenance - Level 1

ML0603-0003 Material Review Maintenance - Level 2

- These 4 specifications implement the first phase of the Wire Action Team approved Boeing recommendation to develop maintenance procedures for repetitive orbiter electrical system maintenance & repair activities.
- The 29 highest priority repair procedures for the orbiter electrical system are incorporated in the initial release of these four specifications. Process Control Records (PCRs) have been developed for each procedure that provide detailed steps and capture all required data and necessary buyoffs.
- Use of these Specs and associated PCRs eliminated need to perform these repairs on an MR basis.

	Presenter:
	Organization/Date: Orbiter/05-16-02

CONFIGURATION CHANGES AND CERTIFICATION STATUS

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

- **18 Modifications Are Being Implemented During the STS-111 Processing Flow**
  - All associated products delivered and certified
  - Total listing of STS-111 modifications and certification details is in backup
- **8 modifications are flying for the first time on STS-111**
  - Summaries to be presented on following pages

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

MCR 19589 Midbody Crossover Bracket Redesign

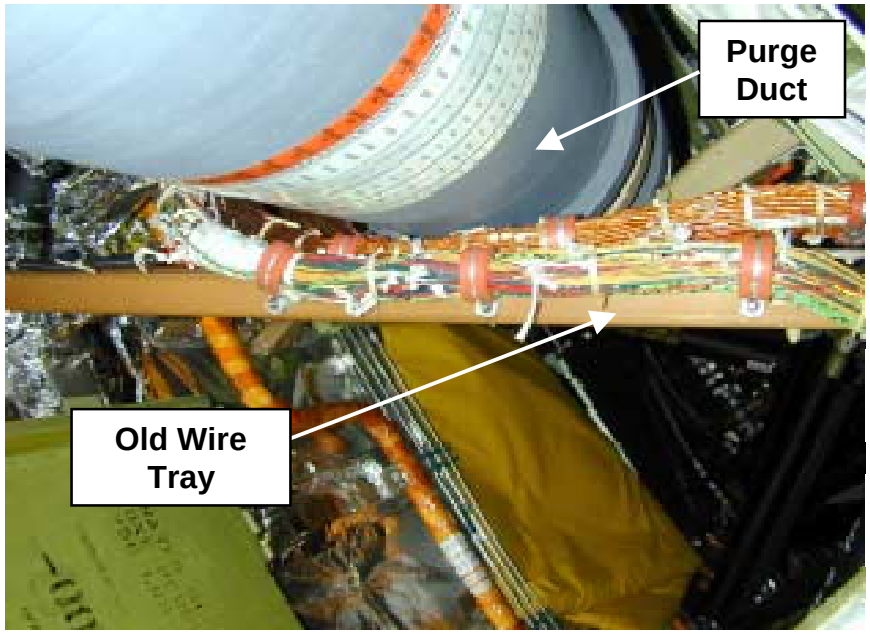
- Interference has existed between the Orbiter midbody centerline purge duct and the wire harnesses contained in the mainframe crossover trays at four locations, Xo 636, 750, 807, and 863
  - Condition has been accommodated by MR utilizing tie-wraps and harness routing that minimizes the interference and teflon wrap to protect the harnesses in the contact area
- Wire trays were redesigned to eliminate the interference as one of the corrective actions out of the fleet wiring investigation
  - The new wire trays curve around the purge duct and allow the harnesses to be mounted on the far side of the tray, keeping the wire harnesses away from the duct which will also accommodate future growth
- During the STS-111 flow, crossover tray changeout was accomplished at three of the four locations due to flow schedule constraints
  - The crossover tray changeout at Xo 636 has been deferred to the STS-115 (flight 20) flow of OV-105

CONFIGURATION CHANGES AND CERTIFICATION STATUS

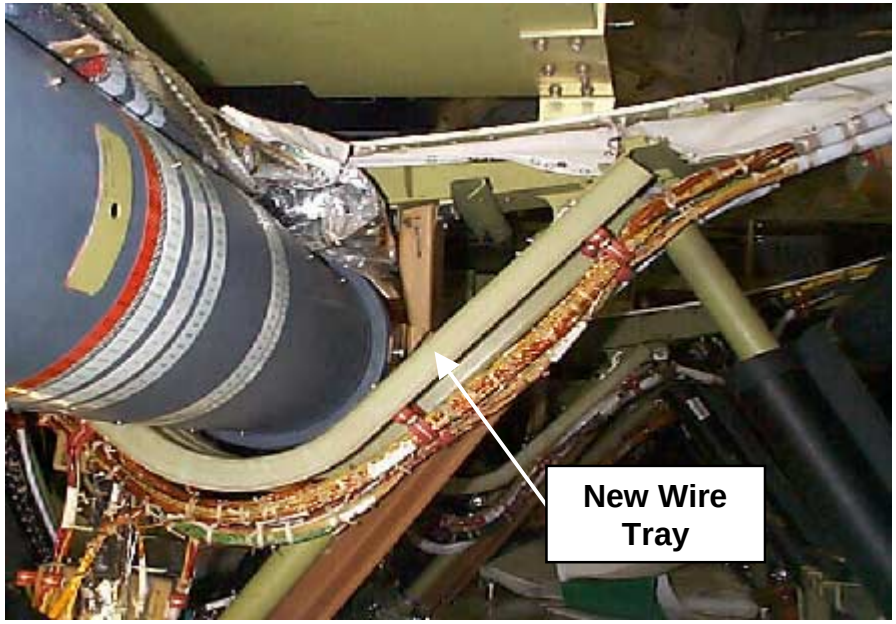
Presenter: Doug White

Organization/Date: Orbiter/05-16-02

MCR 19589 Midbody Crossover Bracket Redesign



Original Crossover Bracket Design



New Crossover Bracket Redesign

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

MCR 19343 MPLM T-0 Data Scar Wiring Implementation

- Orbiter, Payload Integration and GSE modifications will be required in the future to provide MPLM cargo element active cooling, dedicated power, and command / data wiring paths during flight and ground processing
- Added Orbiter data line wiring in the aft fuselage this flow to support early verification testing of some payload and ground support provisions for the future active MPLM
  - Data wiring in the aft from the Xo 1307 bulkhead to the starboard T-0 umbilical links the payload side and the ground side
  - Payload Integration wiring from the MPLM / ROEU location in the payload bay to the Xo 1307 bulkhead
  - Ground Ops provided the ground side wiring from the T-0 umbilical to the MLP and for the landing convoy MPLM Service vehicle (MSV)

CONFIGURATION CHANGES AND CERTIFICATION STATUS	Presenter: Doug White
	Organization/Date: Orbiter/05-16-02

MCR 19112 Wireless Video System (WVS) Spread Spectrum Transceiver Upgrade

- Original WVS system UHF operating frequency band of 400.2 MHz was limited by the FCC through July 2002
- Installed upgraded GFE WVS tranceivers (ORCA-XCVR-11) with a UHF operating frequency band of 400.15 to 401 MHz, approved by the FCC for permanent utilization
  - Replaced the original ORCA-XCVR-01
- Boeing installation drawings and ICD updated to reflect the new GFE tranceivers

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

MCR 19560 FRCS Thermal Clip Deletion

- Deletes the thermal transfer clips from the interface between the FRCS module and lower forward fuselage
- Installation of these numerous clips is a time consuming process during FRCS mate
- Thermal analysis indicates that the clips are not required as their removal will not cause structural thermal gradient concerns
- Work savings process improvement for ground ops

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:
Doug White

Organization/Date:
Orbiter/05-16-02

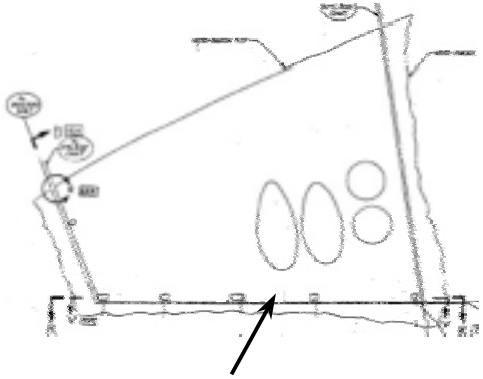
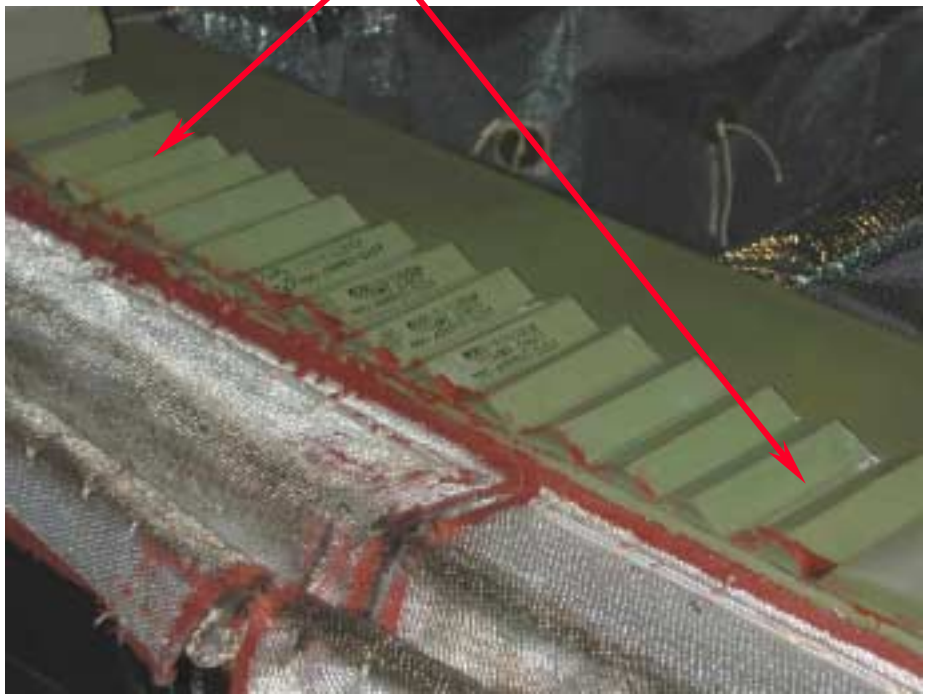


Photo detail at right taken of this location

FRCS Thermal Clips on Lower Forward Fuselage Interface



FRCS Module

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

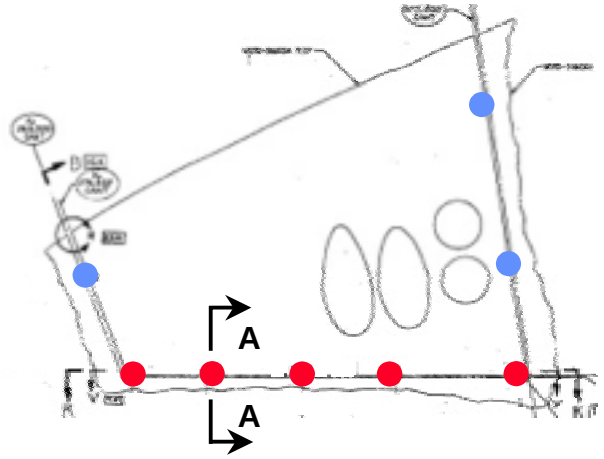
MCR 17177 FRCS Attach Bolt Torque Class Revision

- The FRCS is attached to the forward fuselage at 16 locations
  - The 10 Z-direction mating bolts fasten through the FRCS into cone bolts, which are threaded into the lower forward fuselage and contain a threaded female feature in the cone that receive the mating bolt
- During a recent inspection of OV-102, 4 of the 10 cone bolts had less than the required installation torque
- Investigation revealed that the cone bolt installation torque was to class 1 and the FRCS mating bolt was to class 3
  - Removal of the mating bolts at the higher torque level is believed to have caused the loss of torque on some of the cone bolts
- The design change revised the installation torque of both the cone bolts and the FRCS installation bolts to a class 2 torque to preclude this condition
  - FRCS installation OMI to be revised to require cone bolt torque verification prior to module installation

CONFIGURATION CHANGES AND CERTIFICATION STATUS

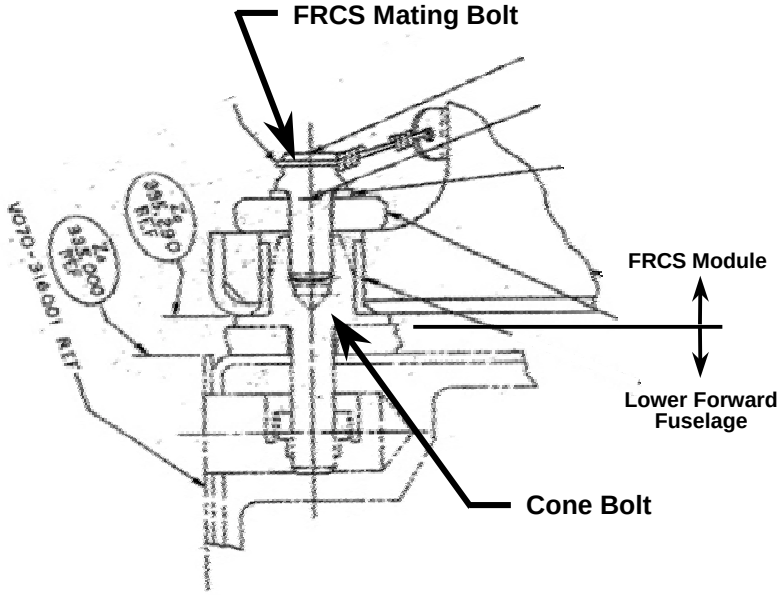
Presenter:
Doug White

Organization/Date:
Orbiter/05-16-02



- Z-Direction Attachment Locations – 5 LH / 5 RH
- X-Direction Attachment Locations – 4 Aft (2 LH / 2 RH) 2 Fwd (1 LH / 1 RH)

FRCS Module – Side View



Section A-A

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

MCR 18755 Lightweight Tool Stowage Assembly (TSA) Tool Retention Enhancement Modifications

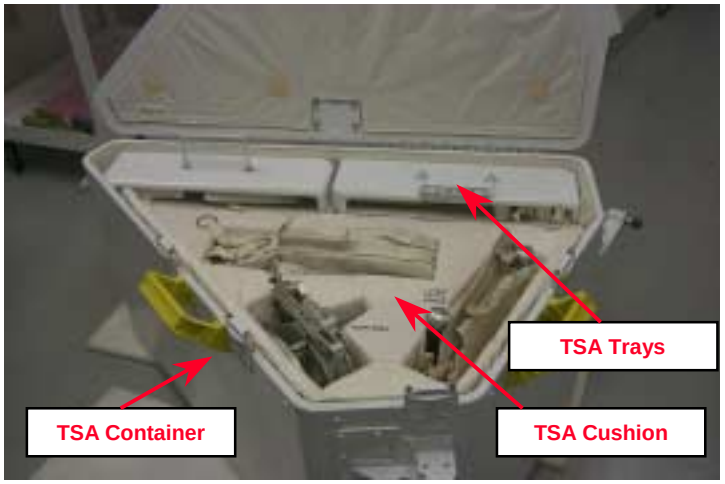
- Corrective actions implemented as a result of tool loss during STS-97 EVA and crew requested enhancements
  - Tray cushioning modified by adding stiffeners in the tool slots for improved tool retention
  - Addition of diagrams depicting proper tool orientation
  - Tray tether strap design improvement to provide a more secure tethering feature of the tray when it is removed from the tool stowage assembly (TSA) during EVA
    - Securing ‘belt loop’ added to cushion assembly

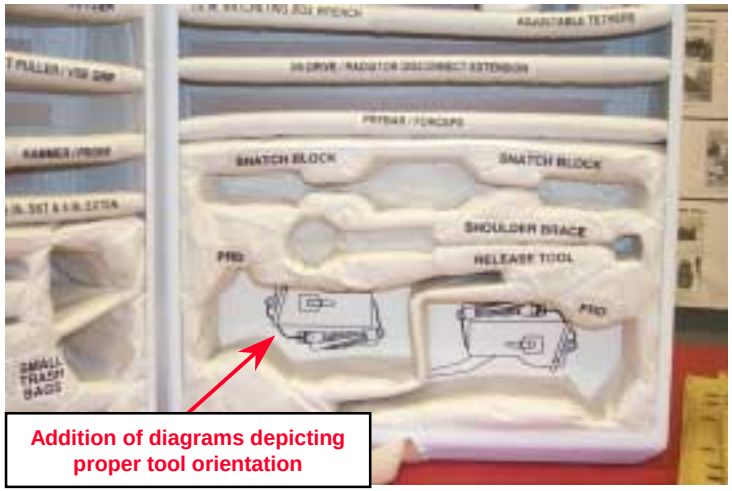
CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:
Doug White

Organization/Date:
Orbiter/05-16-02

MCR 18755 Lightweight Tool Stowage Assembly Modification



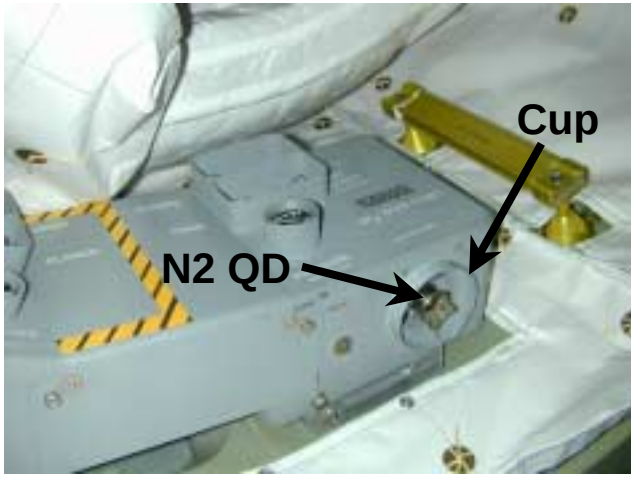


CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

MCR 19670 Nitrogen Transfer Hose Quick Disconnect Release Ring

- The ISS N2 flexible transfer hose attaches to the external airlock N2 transfer panel via a QD
  - The N2 transfer hose remains on the ISS and is mated following docking and hatch opening
  - Hose QD must be able to be quickly released in the event of an emergency undocking
- During STS-110 CEIT, the crew had difficulty gripping the releasing ring to demate the N2 transfer hose QD from the transfer panel
  - Difficulty was caused by the recess of the QD within the “cup” and “cup” diameter

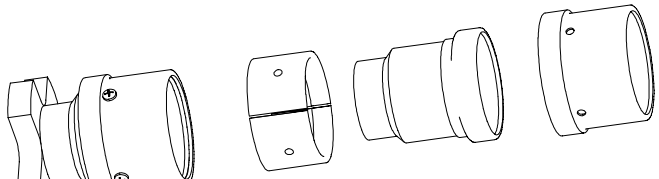


CONFIGURATION CHANGES AND CERTIFICATION STATUS

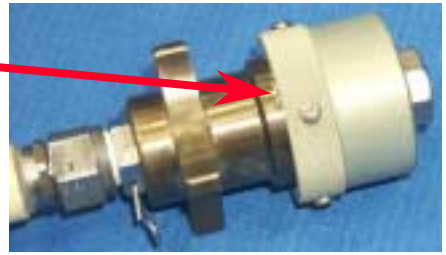
Presenter: Doug White
Organization/Date: Orbiter/05-16-02

MCR 19670 Nitrogen Transfer Hose Quick Disconnect Release Ring

- Redesign adds a ring extension assembly onto the hose QD allowing crew member's hand to easily access and activate the QD's actuating ring
  - New hose assembly will be stowed in a middeck locker for ascent and swapped with the hose assembly currently on the ISS once on-orbit
  - Prototype successfully fit-checked during STS-111 CEIT



Exploded View



CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

MCR 18755 Sky Genie Installation Fastener Change

- Crushed sky genie pouch mounting fastener grommets were observed prior to OV-105's previous mission
  - Attributed to torque engagement force of fully-threaded screw
- For STS-111, grommets were repaired (returned to print) and installation fasteners changed to shoulder bolts to prevent grommet damage

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White
Organization/Date: Orbiter/05-16-02

OMS Engine Fuel Discharge Line Flange Bolts

- Fuel discharge line flange seal changed from Omni-seal to V-seal design with increased bolt torque in mid-1990s
  - Increased torque requirement recently discovered to be beyond rated capability of existing bolt (6 bolts per flange)
- MR procedure implemented to replace suspect A286 bolts with stronger MP35N bolts at a reduced torque on both OV-105 OMS engines
  - Maintains safe bolt preload and large positive margin for prevention of joint gapping
  - Bolts replaced one at a time per validated vendor bolt torque pattern procedure to retain seal integrity
  - OMRSD GHe leak check performed to validate flange joint following bolt replacement
- Certification deviation processed

	Presenter:
	Organization/Date: Orbiter/05-16-02

SPECIAL TOPIC

SPECIAL TOPIC FOR THE STS-111 FLIGHT READINESS REVIEW

Presenter: Doug White

Organization/Date: Orbiter/05-16-02

Topic	Presenter
• Previous FRR Topics Update	Doug White

PREVIOUS FRR TOPICS UPDATE

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

ET Door Drive PDU Torque Limiter Anomaly:

- This anomaly remains an unexplained anomaly
- The previous most likely cause of dynamic contact between the two torque limiter plates has been ruled out by test
  - Stall max torque testing was performed while adding shims using a transfer coating to determine if plate contact had occurred
  - Dynamic contact did not occur until plates were also in contact statically
- Other potential causes including a reduction in the coefficient of friction continue to be investigated
  - The qual torque limiter was assembled and set to a specific Belleville stack height (slip torque measured to be 475-485 in-lbs)
  - The torque limiter was disassembled, cleaned, reassembled, and set to the same Belleville stack height (slip torque 655-675 in-lbs)

PREVIOUS FRR TOPICS UPDATE

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Risk Assessment / Acceptable for STS-111 Flight:

- Flight rationale has not changed from STS-110
- Stall torque on both OV-105 PDUs is known and is sufficient to close the ET doors in flight (min of 7200 in-lbs LH and 8800 in-lbs RH)
  - Worst case torque requirement is 4000 in-lbs during RTLS (TAL and nominal orbit is 800 in-lbs)
  - OMRSD ground testing verifies minimum torque > 7000 in-lbs. each flow
  - The original discrepant OV-105 PDU (TU114) which had the lowest stall torque (6800 in-lbs.) was still capable of fully closing the door during OPF testing
- Even though cause of degradation is still unknown, based on six available data points (out of nine total actuators), the total amount of degradation seen amongst these units is relatively consistent over a long period of time
  - Data does not predict significant near-term degradation to a level below the worst case performance requirement

PREVIOUS FRR TOPICS UPDATE

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Connector Saver Anomaly:

- Continuing investigation at Glenair determined that incorrect pin-side RTV inserts were installed in some of the Orbiter connector savers
  - The difference between the two inserts is in the diameter and angle (shape) of the “shoulder” or raised region around the periphery of each pin
  - Applied axial force from the secondary mate, in series with the connector saver, can wedge the insert shoulders into the receptacle sockets sealing area and thus prevent the bayonet from reseating into the detent area
- Previously reported finding that the “wavy washers” provide insufficient spring force to keep the bayonet pins in the coupling ring locking detent is a contributing factor
  - Wavy washers with the proper heat treat and a higher free standing height would have kept the bayonet pins seated in the detent

PREVIOUS FRR TOPICS UPDATE

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Risk Assessment / Acceptable for STS-111 Flight:

- Previous flight rationale reassessed and revalidated
- 115 connector savers are utilized on OV-105

Location	Qty	Flight Rationale
T-0 Umbilical	23	T-0 carrier plate assembly provides positive spring load to all of the connector savers, in the mating direction, preventing any inadvertent demate Fly as-is
Monoball Production Break	15	Removed - retest successfully completed
OMS Pod	24	Strips of 3M-363 tape added to prevent locking ring rotation
P/L electrical services	3	No mating harness
OMS Pod Gnd Test	4	No mating harness
Ku-Band EA-1, EA-2 & SPA (Located in Fwd Av Bays)	17	1R2 (worst case) IFMs exist if connector becomes disengaged Fly as-is
Various feed-thru locations	29	No secondary mate which would create an opportunity for axial load to shift the bayonet pin out of the detent. Connector mate procedures and processes ensure proper engagement of the primary mating connector detent pin. No previously reported instances of connector detent engagement problems with primary connector mate. Fly as-is

PREVIOUS FRR TOPICS UPDATE

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Hydraulic Pump Processing Discrepancies:

- During continuing process review at Parker-Abex, the SRB Element uncovered four more discrepancies associated with hydraulic pump processing
  - Pumps subjected to materials not approved per Parker-Abex specifications and procedures
- Orbiter Element M&P has assessed the out-of-specification processes and verified each does not impact hardware integrity or readiness for flight
  - Mineral Spirits fast-dry 360 used in place of specified solvent (Sovasol 5 or 3135 Naphtha) for piece part cleaning
    - Similar chemical properties, no material compatibility issues with flight hardware or the hydraulic fluid itself
  - Hydraulic assembly lube AFS-682 used in place of MIL-H-83282 hydraulic fluid to lubricate mid case o-rings
    - By design, AFS-682 (a hydraulic fluid/acrylic copolymer blend) is compatible with MIL-H-83282 hydraulic fluid
      - Tested by the Air Force and approved for use by MDC in St. Louis
    - Only a trivial amount of the more viscous AFS-682 is typically used by Parker-Abex as an assembly aid to hold the o-ring in place, with the residual dissolving into the hydraulic fluid
      - The o-ring itself is composed of a rubber fluorocarbon elastomer that is compatible with hydraulic fluids and most solvents
    - Parker-Abex has used AFS-682 on their pumps for many years

PREVIOUS FRR TOPICS UPDATE

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Hydraulic Pump Processing Discrepancies: (cont)

- Electrical connectors were cleaned with Mineral Spirits fast-dry 360 instead of Spirit-126 and were dried with shop air instead of bottled breathing air or a hot air dryer
  - Parker-Abex has confirmed that they do not clean or dry Orbiter pump electrical connectors
    - In addition, the functions running through these connectors are verified during vendor ATP, OMRSD File IX in-flight checkout and during electrical depress checkout as part of ground processing
  - Only SRB pumps, which utilize underwater electrical receptacles, require cleaning/drying due to salt water immersion
    - SRB M&P has confirmed that chemically, Mineral Spirits fast-dry 360 and Spirit-126 are similar (both being saturated hydrocarbons differing only in molecular weight), both evaporate very rapidly and present no compatibility issues with any part of the connector

PREVIOUS FRR TOPICS UPDATE

Presenter:
Doug White
Organization/Date:
Orbiter/05-16-02

Hydraulic Pump Processing Discrepancies: (cont)

- Use of shop air can present a cleanliness concern associated with oil from the compressor getting on the part
  - As is typical at SRB facilities when breathing air is not available, a blotter test conducted on the shop air at Parker-Abex has provided assurance that the presence of oil and water has not adversely effected the connectors
  - SRB pump connectors are cleaned, visually inspected, greased and undergo electrical and functional checkout (which includes multiple cycles on the solenoid) as part of vendor ATP
  - These connectors are inspected and tested again at KSC prior to flight, at which time any anomalous condition would result in another connector cleaning, re-inspection and re-greasing
- In summary, there have been no reports of any Orbiter or SRB pump problems resulting from these processing discrepancies
- Since noted discrepancies are technically acceptable, final resolution will be to update vendor documentation to reflect actual practice
  - SRB's PR will be utilized as interim documentation to allow continuation of process validation
  - Orbiter's existing Parker-Abex PCAR will also be used to document these discrepancies

RMS D&C Panel Single/Direct Drive Switch Life Issue

Presenter Doug White

- Switch "Feathering" technique used by the crew in Single joint drive modes significantly increases Single/DD switch cycles:
  - Feathering technique is partial engagement of switch mating contacts to controls rates in single drive
  - Original Estimate = 54 cycles per mission
  - Actual with Feathering = 1,747 per mission (average)
- SPAR-RMS-R.116 (Rev G) initially listed switch life limited to 5,000 cycles.
- Flight Switch Cycles
  - OV-105/STS-111, 26404 total switch throws
  - OV-104/STS-110, 27064 total switch throws, No anomalies observed
- Two flight equivalent switches ME452-0102-7305 are being endurance tested at JSC RITF Lab (as per test plan SRMS.40579).
  - Test results to date are 70,000+ cycles
- SAIL switch estimated to fail at approximately 32000 cycles.

RMS D&C Panel Single/Direct Drive Switch Life Issue

- CIL retention rationale for Crit 1/1 failure:
  - Crew Trained to monitor arm motion and apply brakes if it is not responding properly to commands.
  - Worst Case runaway would be @ vernier joint rate limit - not max rate.
    - Note: Switch failure during Direct Drive Checkout or DD contingency ops would be at Direct Drive rates.

- MOD/CREW will reassign Single switch to Auto Sequence Proceed/ Stop switch for Single Joint Mode operations (as per STS-110).
  - DX22 concurs.
  - Reduces risk in Single mode.
    - Switch has significantly less cycles than Single/DD switch (<1% of Single/DD switch).
    - Reduces cycles on Single/DD switch approx 60% or greater.

	Presenter:
	Organization/Date: Orbiter/05-16-02

FLIGHT READINESS STATEMENT

SSVEO is Ready to fly STS-111

ORBITER
FLIGHT SOFTWARE
FLIGHT CREW
EQUIPMENT

P.E. Shack, Manager
Shuttle Engineering Office

/s/D. Stamper
D. E. Stamper, TMR
Software

/s/F. Ouellette
F. A. Ouellette, Manager
Flight Crew Equipment Management Office

P. A. Petete, Acting TMR
Orbiter and Flight Crew Equipment

ORBITER/FLIGHT SOFTWARE

B. I. Bejmuk, Program Director, Orbiter
Human Space Flight and Exploration
The Boeing Company

J. Wilder, Associate Program Manager
Orbiter ElementUnited Space Alliance

/s/R. Parrott for
T. F. Peterson, Associate Program Manager
Flight Software Element
United Space Alliance

FLIGHT CREW EQUIPMENT

/s/J. Buchli
J F. Buchli, FCE/EVA Associate
Program Manager
United Space Alliance

RMS

/s/S. Higson
S. Higson, Program Director, SRMS
McDonald Dettwiler and
Advanced Robotics Limited

/s/R. Allison
R. Allison, RMS Project Manager

SVS

N/A
L. Beach, Program Manager, SVS
NEPTEC

N/A
D. S. Moyer, SVS Integration Office

FERRY FLIGHT PLANNING

/s/D. McCormack
D. L. McCormack, Ferry Flight Manager

Ralph R. Roe, Manager
Space Shuttle Vehicle Engineering

	Presenter:
	Organization/Date: Orbiter/05-16-02

BACKUP INFORMATION

	Presenter:
	Organization/Date: Orbiter/05-16-02

PREVIOUS FLIGHT ANOMALIES BACKUP

	Presenter:
	Organization/Date: Orbiter/05-16-02

STS-108 IN-FLIGHT ANOMALIES BACKUP

STS-108-V-01 & STS-108-V-02: RCS THRUSTERS R4U AND F3F FAILED OFF	Presenter:
	Organization/Date: Orbiter/05-16-02

Observation:

- Thruster R4U failed off during mated coast
- Thruster F3F failed off during ISS docking

Concern:

- Loss of RCS thruster redundancy

Discussion:

- R4U failed off during first commanded firing
  - Chamber pressure (Pc) reached max value of 15.8 psia
  - RM deselected thruster due to failure of Pc to reach 26 psia within 320 ms
- F3F failed off during first commanded firings
  - Pc reached max value of 6.4 psia
  - RM deselected thruster after three successive 80 ms low Pc pulses

STS-108-V-01 & STS-108-V-02: RCS THRUSTERS R4U AND F3F FAILED OFF	Presenter:
	Organization/Date: Orbiter/05-16-02

Discussion:

- Fuel and oxidizer flow was evident by drop in injector temps during both failures
- Low Pc and injector temp drop indicate partial flow on one valve and full flow on other valve
- The two most likely causes were considered to be ox valve nitrate contamination or fuel valve extrusion
- 6th flight for both thrusters since last installation/flushing
- Thrusters were deselected for remainder of mission

Actions Taken / In Work:

- Failed thrusters R4U and F3F were removed and replaced
  - Required entire manifold associated with each failed thruster to be R&R'd to prevent sympathetic failures
- Failed thrusters sent to WSTF for TT&E
  - GN2 response test isolated both failures to the fuel valves
    - Main stages did not open
  - Force deflection test confirmed confirmed fuel valve extrusion

STS-108-V-01 & STS-108-V-02: RCS THRUSTERS R4U AND F3F FAILED OFF	Presenter:
	Organization/Date: Orbiter/05-16-02

Risk Assessment:

- Failed off thruster is Crit 1R/3
  - Redundant thrusters exist in all firing directions
  - Extensive flight history of failed off thrusters
    - Well documented and understood failure mode
- Risk mitigation actions are in place
  - Preventative maintenance flushing performed on all primary thrusters at OMM, as well as those used for in-flow replacements
  - Full manifold R&R required for any thruster removal to preclude collateral damage
  - GN2 chamber purge implemented during turnaround operations to reduce propellant vapor build-up
  - Molecular sieve of oxidizer implemented at KSC

STS-108-V-01 & STS-108-V-02: RCS THRUSTERS R4U AND F3F FAILED OFF	Presenter:
	Organization/Date: Orbiter/05-16-02

Acceptable for STS-111 Flight:

- Failed thrusters R4U and F3F were removed and replaced
  - All thrusters on associated manifolds were R&R'd to prevent future sympathetic failures
- Risk mitigation actions in place to reduce failures
- Flight rules exist for failed off thrusters
- Redundant thrusters exist for each firing direction
- Not a safety of flight issue

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Observation:

- During STS-108 mission, IMU 2 annunciated Redundant Rate and Platform Fail BITES (07:07:20 MET)

Concern:

- Although the observed anomaly is transient in nature, a hard failure of IMU 2 would result in loss of one level of redundancy

Discussion:

- Data review indicates that reported anomaly was the result of degraded performance associated with the Z / redundant axes of the Azimuth gyro
  - Redundant rate measured >3.0 deg/hr (0.006 deg/hr = 1-sigma)
- The anomaly persisted for approximately 45 minutes, after which time IMU 2 resumed normal operation and the BITEs cleared
- The crew commanded IMU 1 from Standby (due to Group B power-down) to Operate mode and deselected IMU 2 and masked the alarm
- IMU 2 was reselected for entry and exhibited nominal performance during entry and landing

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Discussion: (Cont)

- Data indicates that the signature is not consistent with a known gyro bearing lubricant issue
  - A gyro bearing problem is characterized by a gradual, yet progressive, performance degradation (i.e., it does not cure itself)
- Review of HAINS IMU failure history has identified one other instance of a redundant rate anomaly
  - During STS-65 (OV-102), redundant rate parameter exhibited a 0.7 deg/hour drift rate in HAINS S/N 204 (ref. CAR 65RF04)
    - Despite the intermittent nature of the observed redundant rate anomaly, HAINS S/N 204 was inserted in the redundant set and successfully supported entry
  - Subsequent TT&E identified a generic defect in the press-fit ground connections of the HAINS DC/DC circuit cards
    - In 1995, a fleet-wide retrofit replaced all press-fit grounds with a simple, yet more reliable, design (employs a terminal lug, bolt, lock washer and nut to achieve the desired ground connection)

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Actions Taken:

- IMU 2 (HAINS S/N 207) was removed from OV-105 and replaced with S/N 213, which has successfully passed initial OMRSD testing
- S/N 207 was sent to JSC/ISL for initial testing
  - Readout of internal EEPROM indicates that Gyro Wheel Supply BITEs occurred, which caused the Platform Fail BITEs observed in flight
    - Indicates that during the anomaly, the gyro wheel was not operating at correct speed, possibly due to open connection in the speed control loop
  - Testing at ISL attempted to recreate anomaly by duplicating gimbal attitudes experienced during the time that anomaly was observed in flight
    - During approximately three weeks of testing, overall good performance of the IMU was observed
    - The flight anomaly was not recreated and gyro wheel speed control circuit measurements indicated it was functioning properly

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Actions In Work:

- HAINS IMU S/N 207 was sent to the vendor (Kearfott) for more extensive failure analysis testing
  - TT&E at Kearfott has shown that one of two phases of the Z-axis/ Redundant Rate gyro motor drive current opens over a large range of azimuth gimbal angles
    - Gyro motor requires both phases to accelerate up to running speed, but will maintain speed with only one phase.
    - A second fault will allow gyro wheel to slow down – resulting in anomalous performance similar to that observed during STS-108
  - TT&E is continuing to isolate the faulty component(s)

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Risk Assessment:

- HAINS IMUs have a very good operating history
  - Only 8 operational anomalies since these IMUs were introduced in the Orbiter fleet (11/91)
- The IMU's installed in OV-105 have a good pedigree
  - IMU's 1, 2 and 3 have successfully supported 12, 12, and 13 Orbiter missions, respectively
- Criticality of the IMU is 1R3 for loss of output, 1R2 for erroneous output
- Flight rules permit continuation to NEOM following the loss of one IMU
- A second IMU failure would result in a next PLS if system loses all fault tolerance or failure is considered generic

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Acceptable for STS-111 Flight:

- IMU 2 (HAINS S/N 207) was removed and replaced with S/N 213, which has successfully passed initial OMRSD testing
- IMUs 1 and 3 have also passed initial OMRSD testing
- These LRUs will receive V1043 and Pre-Flight Calibration testing prior to launch
- The OV-105 IMUs have a good performance pedigree
- The IMU has adequate system redundancy

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

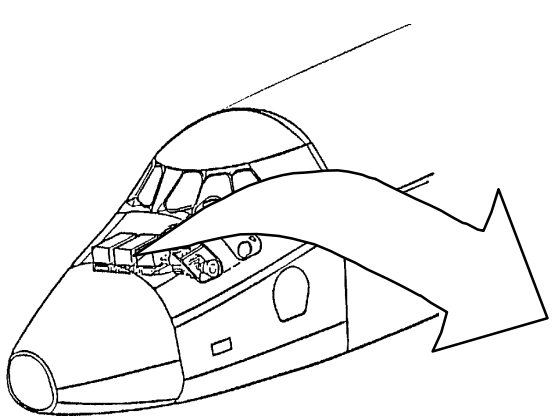
OV-105 IMU Pedigree

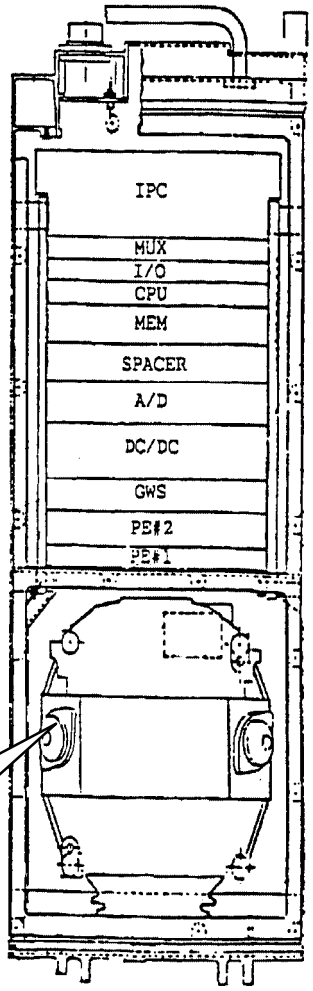
Slot #	S/N	Operate Hours (approx.)	Prior Flights	Gyro Vertical	Gyro Azimuth	Operational Failure History
1	212	4315	12	New	Old	Broken Gyro Pickoff Wire (KB3294)
2	213	5038	12	Old	Old	Roll/Pitch Non-Orthogonality (DP) And Pitch Offset (PO) shifts due to shipment –(New Shipping Container and Methods Implemented to Prevent Prob.) (AD8736)
3	216	4442	13	Old	Old	None

STS-108-V-03: IMU-2 Z-AXIS / REDUNDANT RATE ANOMALY

Presenter:

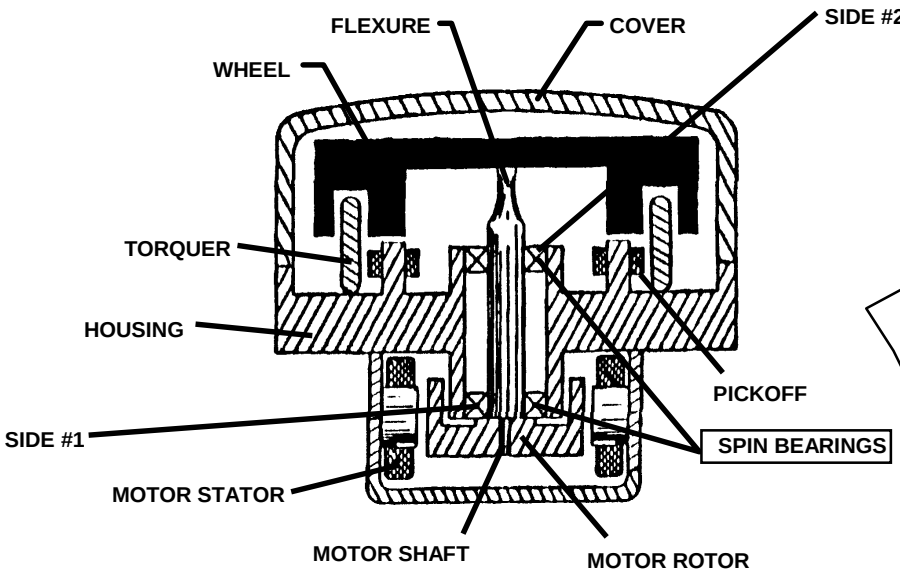
Organization/Date:
Orbiter/05-16-02





HAINS CHASSIS - TOP VIEW

GYROFLEX GYRO



STS-108-V-04: FES SECONDARY CONTROLLER ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Observation:

- The FES failed to control the outlet temperature during on-orbit check-out of the FES secondary controller

Concern:

- Loss of redundant FES control, and redundant cooling to the orbiter

Discussion:

- During STS-108 on-orbit FES check-out (MET 011:15:35) after the radiator cold soak, with the hi-load evaporator enabled using the A supply valve, the FES outlet temperature oscillated between 45°F and 80°F when the secondary controller was activated
  - FES outlet temperature was unstable (normally takes 2 minutes to stabilize)
  - Outlet temperature stabilized at 62°F when the topping evaporator was selected

STS-108-V-04: FES SECONDARY CONTROLLER ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Discussion: (cont)

- This was the first occurrence in the Program of this type of anomaly
- FES checkout continued in the full-up mode with the primary B controller, and the FES performed nominally to EOM
- The FES has two redundant primary controllers (A & B) and one secondary controller with three modes (hi-load A water supply, hi-load B water supply or topper)
  - Normal orbiter operation only requires primary controller function
  - Secondary controller only used for contingency operations
    - Loss of primary controllers
    - Flush technique for FES shut down

STS-108-V-04: FES SECONDARY CONTROLLER ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Discussion: (cont)

- Post-flight troubleshooting of OV-105 FES isolated the secondary mid-point temperature sensor as the cause of the STS-108 anomaly
  - Controller functional test performed with nominal results
  - Steady state reading of the sensor was within 0.25°F of the two primary sensors
  - However, transient (ramp) test showed a 2-second lag in the midpoint sensor
    - Previous experience indicates loss of thermal conductivity of packing

Actions Taken:

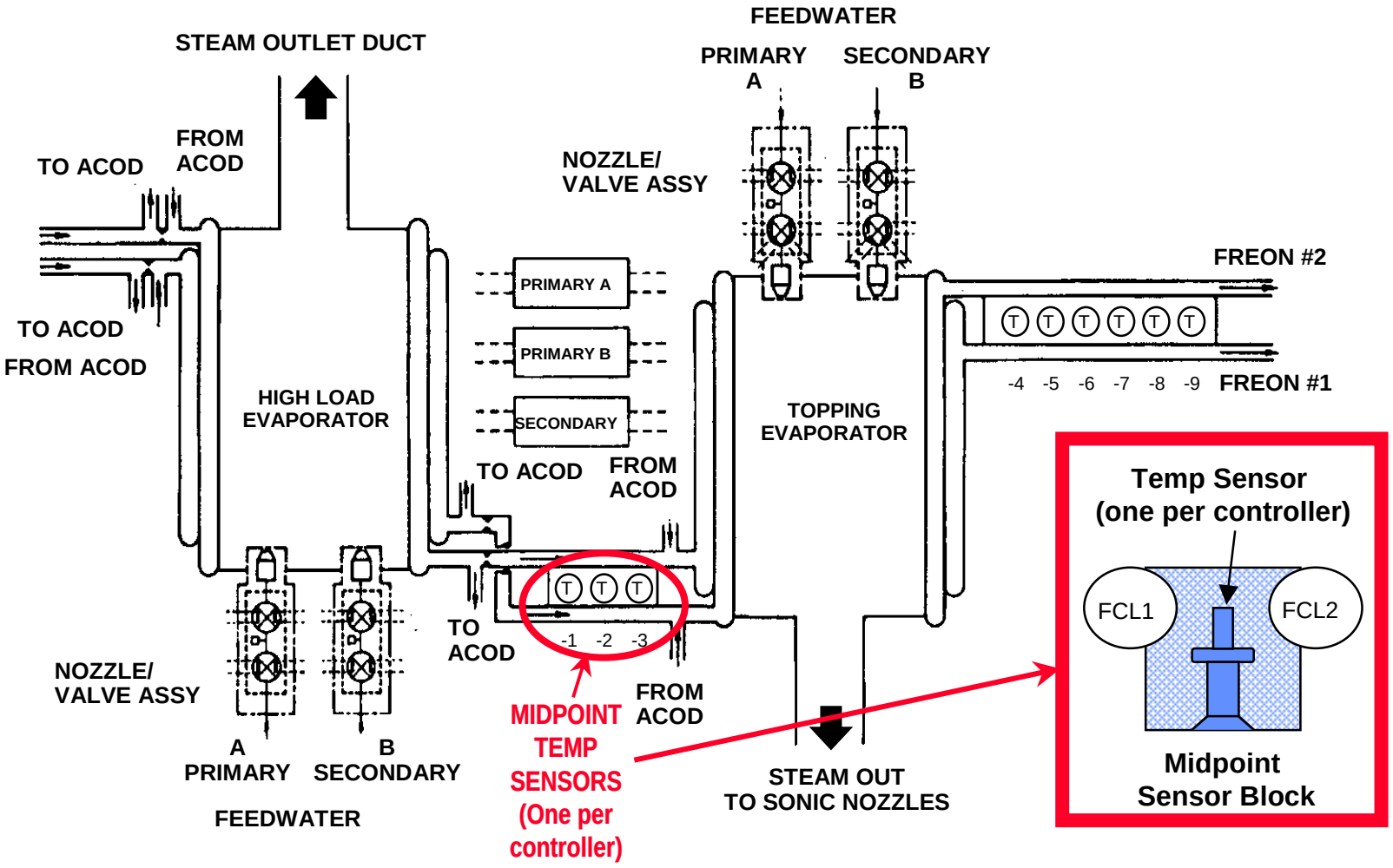
- Sensor has been R&R'd and repacked
  - OMRSD test has been performed to verify sensor performance

STS-108-V-04: FES SECONDARY CONTROLLER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

FES FLUID SCHEMATIC



STS-108-V-04: FES SECONDARY CONTROLLER ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

Risk Assessment:

- Secondary controller is criticality 1R3 for complete failure to operate
  - Primary A and primary B controllers provide the first and second level of redundancy
  - Secondary controller is not required for normal orbiter operations
  - Contingency operations still possible with unstable outlet temperature
- Midpoint sensor performance history indicates that settling of the midpoint sensor packing is infrequent

Acceptable For STS-111 Flight:

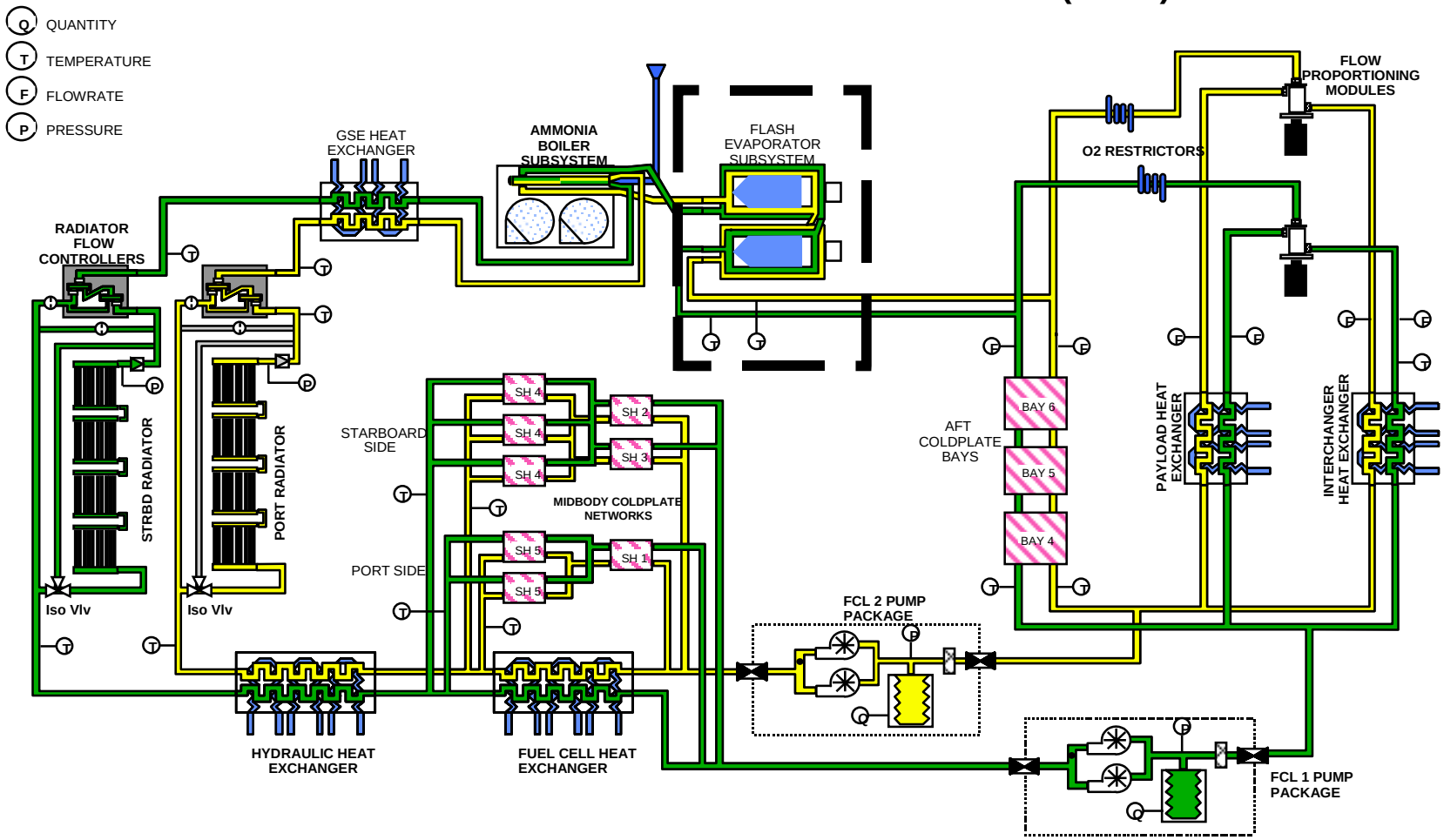
- Cause of the OV-105 STS-108 anomaly isolated to the secondary mid-point temperature sensor
  - Sensor has been R&R'd and repacked and its performance verified to OMRSD requirements
- Checkout of OV-105 FES controllers and primary midpoint sensors was nominal
- Adequate system redundancy exists

STS-108-V-04: FES SECONDARY CONTROLLER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

ORBITER ACTIVE THERMAL CONTROL SYSTEM (ATCS)



	Presenter:
	Organization/Date: Orbiter/05-16-02

CONFIGURATION CHANGES AND CERTIFICATION STATUS

BACKUP

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Current Mission Requirements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19563 SSME Thrust Structure Micro-Strain Gauge Units (SGU) Instrumentation Mission Kit MVO886A				N/A *	N/A	* Boeing certification is not required. Micro-SGU instrumentation and installation certified by GFE GCAR.

- Background:
  - Life analysis of orbiter primary structure to performance enhancement environments showed there are four aft fuselage titanium thrust structure components with life limitations
    - Engine 1, 2 & 3 pitch actuator fittings and the "upper beam"
    - Strut attach lugs on these components are critical
  - Fracture analysis conservatism will be validated using instrumentation flight data
  - Stand-alone Micro-SGU's installed at six locations on thrust structure struts which attach to these lugs will collect actual flight strain data to aid in the component life extension
    - The six locations or groups will be instrumented by two strain gauges each (primary and secondary measurements) at each location recorded by a Micro-SGU recording unit (six locations, twelve total strain gauges, six Micro-SGU recording units)
  - During the STS-108 processing flow, seven of twelve Micro-SGU's were installed and flight ready
    - Due to flow time constraints, four installations (both primary and secondary measurements for groups 4 & 5) were not completed and activated for flight and were deferred to STS-111
    - A secondary measurement for group 2, engine 1 pitch actuator, had not been defined due to structural interferences at the desired location
    - Of note, the primary group 2 measurement failed off-scale low during STS-108
- STS-111 Flow Activity:
  - The four installations for measurement groups 4 & 5, deferred from last flow, were completed
  - The secondary measurement for group 2 was defined and installed, and the primary measurement for group 2 repaired

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Future Mission Requirement

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19343 MPLM T-0 Data Scar Wiring Implementation FIRST FLIGHT				N/A *	N/A	* Previously certified materials and processes.

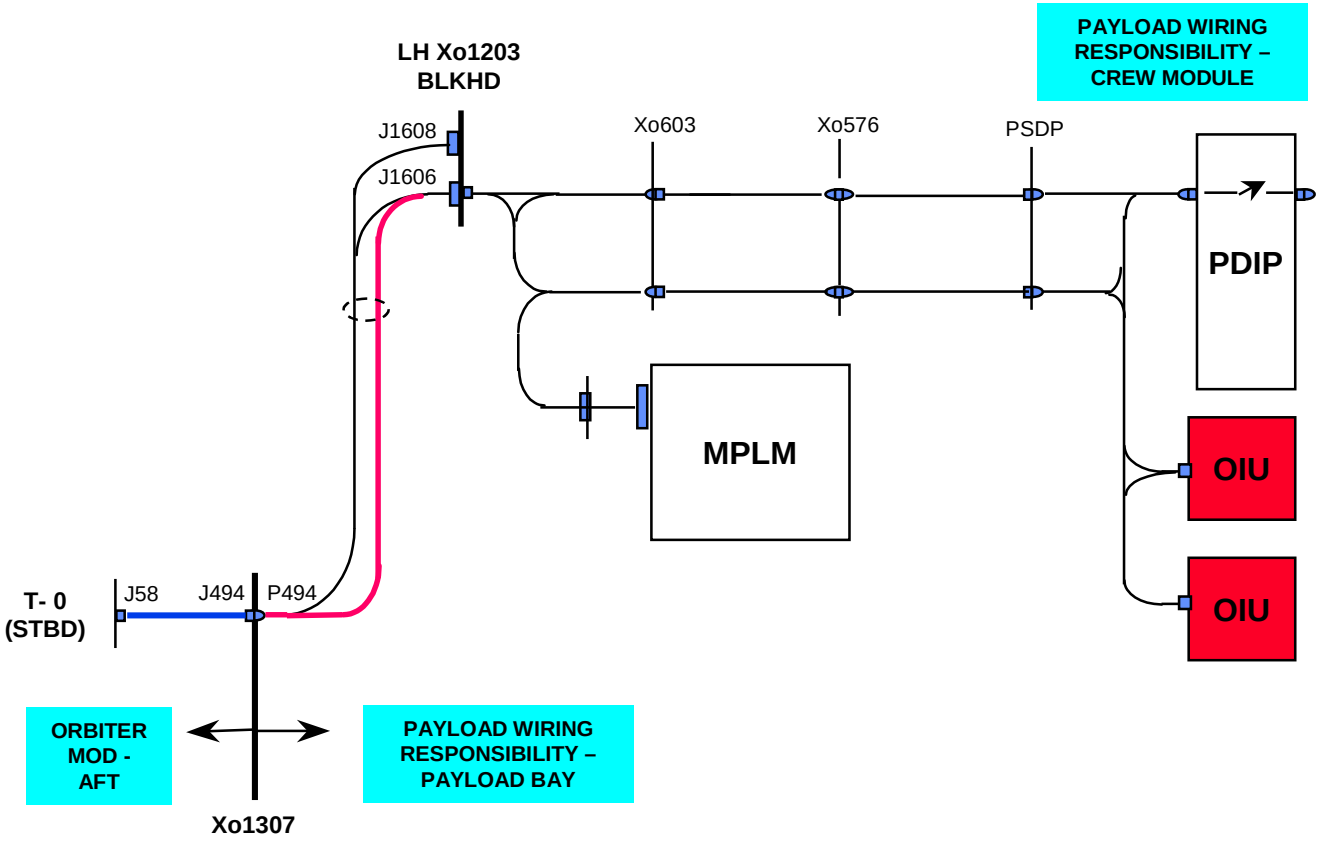
- The Multi-Purpose Logistics Module (MPLM) is a cargo element for transporting and transferring supplies and materials to the International Space Station
  - Future flights of the MPLM will provide capability to transport perishable materials requiring refrigeration
  - Thus, Orbiter and Payload Integration modifications will be required to provide active cooling for the MPLM during flight and ground processing, which include vehicle and T-0 umbilical modifications to provide MPLM dedicated 120v power and 1553 data wiring paths
- MPLM requires power and command / data handling services provided by the OPF, MLP and the MPLM Service Vehicle (MSV), a mobile control room which will be a part of the landing convoy
  - Routing of the power and command / data wiring will be joint responsibility
    - Payload Integration has responsibility of wiring from the MPLM / ROEU location in the payload bay to the Xo 1307 bulkhead
    - Orbiter has responsibility of wiring in the aft from the Xo 1307 bulkhead to the starboard T-0 umbilical and the modifications to the T-0 umbilical
      - Aft fuselage data line scar wiring installed this flow
    - Ground Ops will provide the ground side wiring from the T-0 umbilical in the OPF, for the MLP and for the landing convoy MSV (T-0 to the existing purge trailer and ultimately to the MSV)
- Ground Ops and payload integration requested early verification and checkout of the T-0 data wiring concept prior to the first actively cooled MPLM flight, which will be accomplished during this processing flow in the OPF and at the PAD via chits J5463 and J5464

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

MPLM T-0 Data and Power Scar Wiring Implementation



CONFIGURATION CHANGES AND CERTIFICATION STATUS

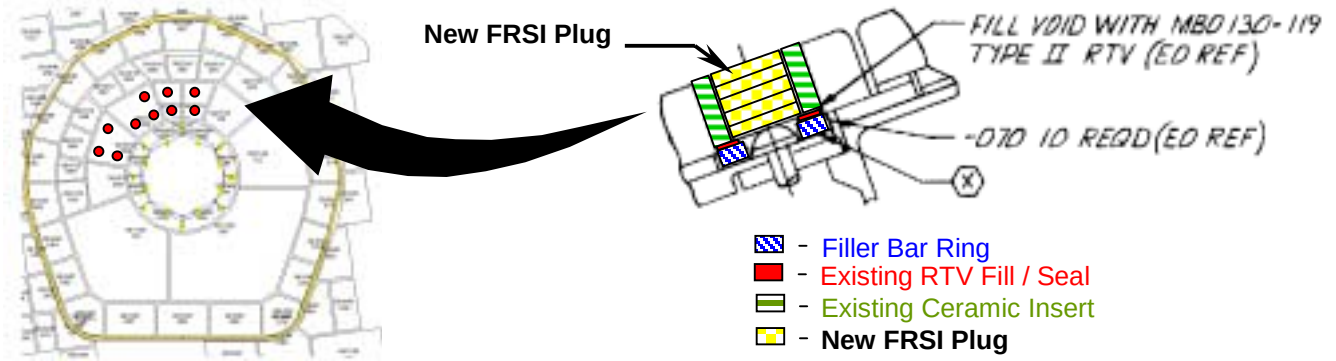
Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Process Improvements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19309 Side Hatch Carrier Plate Insert FRSI Plugs				N/A *	N/A	* Previously certified materials and processes. • Filler bar closeout rings at the bottom of the side hatch carrier panel fastener ceramic plug inserts are experiencing flow erosion • Requires that the filler bar closeout rings be removed and replaced on a frequent basis • Ceramic closeout plugs for the rings had been eliminated early in the program as a processing schedule savings • Mod installs FRSI plugs (10 plugs in 4 tiles) in the ceramic inserts to prevent flow intrusion into the fastener/insert hole to prevent filler bar erosion



CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Process Improvements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19560 FRCS Thermal Clip Deletion FIRST FLIGHT		X		CAR 137-01-320101-058H	4/5/02 A	• Deletes thermal transfer clips from the interface between the FRCS module and lower forward fuselage • Installation of these 477 clips is a time consuming process during FRCS mate • Thermal analysis indicates that the clips are not required and their removal will not cause structural thermal gradient concerns • Work savings process improvement for ground ops

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Mandatory

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19112 Relocation of Payload Bay 4 Sill Longeron Wire Support Brackets Mission Kits MVO073A & MV0874A				N/A *	N/A	* Structure and wiring certification not affected

- Interferences were identified in payload bay 4 (port and starboard) during OV-102, STS-109 flow processing between Wireless Video System (WVS) hardware and active latch / latch support hardware
- Less than required dynamic clearance between latch and WVS sill coax L-bracket support clip
  - Condition corrected by rotating the L-bracket 180 degrees on the sill longeron to provide the additional required clearance (~1") in the Y-direction
  - EO also required against M072-794026 WVS sill coax installation tech order to reflect routing to the new bracket orientation
- Hard interference identified between the WVS antenna mounting bracket and the "license plate frame" used to coil and stow latch wiring
  - Corrected by relocating the license plate bracket ~3.5" aft to eliminate the interference
- This was a mandatory mod to accommodate the STS-111 bay 4 active latch/license plate frame configurations

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

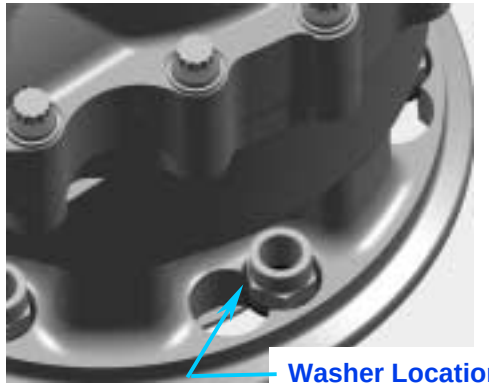
Organization/Date:
Orbiter/05-16-02

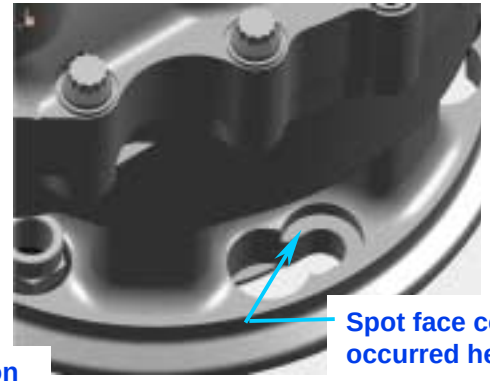
OV-105 STS-111 Modifications and Certification

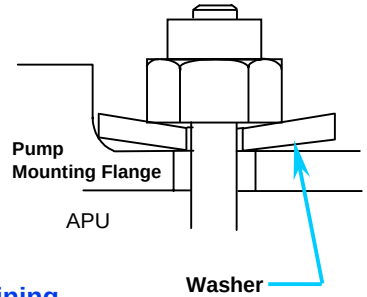
Corrective Action Mandatory

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 12999 Main Hydraulic Pump Mounting Flange Washer Modification		X		04-30-580100-001F	3/26/02 A	

- During installation of APU 3 on OV-102, it was noticed that the washers used on the main hydraulic pump mounting flange were 'cupped'
- A recent change had been made to increase the washer outside diameter to prevent coining of the pump mounting flange
  - Larger diameter increases load bearing area / distribution
- Tolerance study indicates that worst case conditions could cause the larger diameter washer to hang up in the spot face radius
  - Application of nut torque causes the washer to bend or cup
- Over time, cupped washers may relax, resulting in loss of preload, which could result in reduced joint fatigue life
- Modification installed redesigned washers with a slightly reduced outside diameter to accommodate tolerance conditions and eliminate the installation interference (PR-EO to Follow)







CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Mandatory

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19589 Midbody Crossover Bracket Redesign FIRST FLIGHT		X		160-02-340004-002L	10/11/01 A	• Certification for new wiring crossover brackets

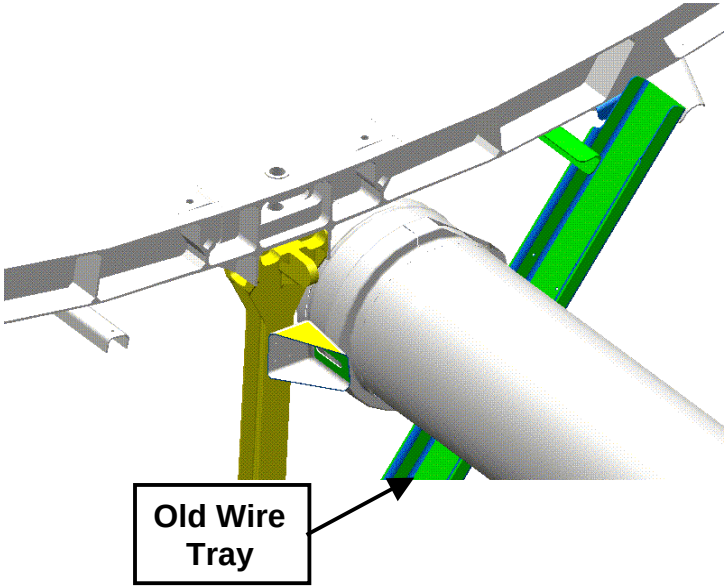
- Interference has existed between the Orbiter midbody centerline purge duct and the wire bundles contained in the mainframe crossover trays at four locations, Xo 636, 750, 807, and 863
  - The condition has been accommodated by MR utilizing tie-wraps in lieu of P-clamps to secure the harnesses and minimize the interference and application of teflon wrap to protect the harnesses in the contact area
- As part of the corrective actions from the fleet wiring investigation, it was determined that the existing wire support trays should be redesigned to eliminate the interference
  - The new wire tray curves around the purge duct and allows the harnesses to be mounted on the far side of the tray, keeping the wire harnesses away from the duct
  - Additionally, the new wire tray will accommodate future growth.
- During the STS-111 flow, crossover tray changeout was accomplished at three of the four locations (Xo 750, 807, and 863) due to flow schedule constraints
  - The crossover tray changeout at Xo 636 will be deferred to the next (STS-113) flow of OV-105
- Wire function separation was engineered as part of this modification, however, could not be accomplished during this flow's tray changeout, because of insufficient flow time.
  - This work will be performed at OMM

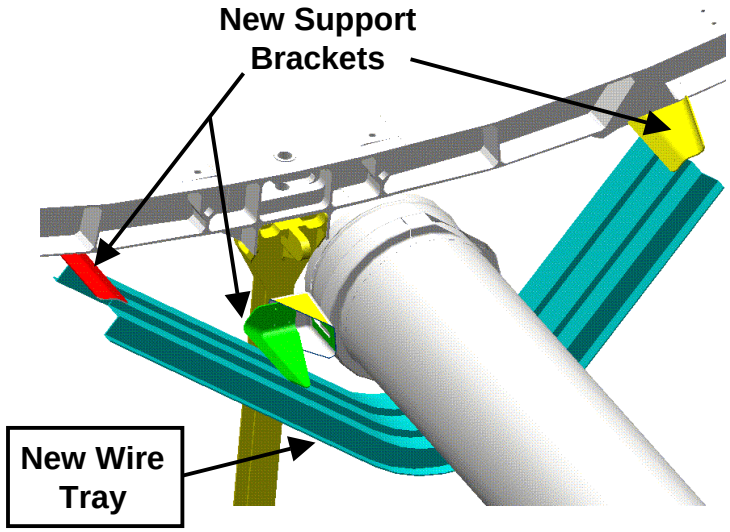
CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

Midbody Crossover Bracket Redesign





Old Design

New Design

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Mandatory

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19527 Critical Wire Redundancy Separation				N/A *	N/A	* Previously certified materials and processes.

Background:

- In 129 instances across the fleet, redundant wiring for crit 1 functions were routed together in common wire harnesses
  - 107 affected areas on OV-105 (OV-103 & subs) - 22 being unique to OV-102
  - Increased risk of system failure - loss of single wire harness could result in the loss of a critical function
  - Condition previously waived
- As part of the corrective actions from the fleet wiring investigation, it was determined these wires should be separated
  - Primary option was to separate redundant wires into separate existing or new harness runs
  - Secondary option was to separate redundant wires within a bundle using barrier material (i.e. convoluted tubing, teflon or mystic tape
  - Correction was not implemented if the determination was made that there would be significant risk to damaging wiring in the rework area versus benefit of the separation, or if major rework/redesign was required to accomplish(i.e. guillotines & hinged D&C panels)

Modification Performed This Flow:

- During last (STS-108) processing flow, 52 circuits were separated, however, separation of the critical wire functions at the Xo807 midbody frame was not accomplished as intended
  - The wire separation was implemented using convoluted tubing instead of actual physical separation
    - This installation was accepted by MR for one flight
  - During this flow, the separation was implemented by physical separation according to the original design intent

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19670 Nitrogen Transfer Quick Disconnect Release Ring Modification Mission Kit MVO857A FIRST FLIGHT			X	01-22-276-0054-1001A	4/25/02 A	• Adds ring extension assemblies onto the N2 QD on the hose assembly which mates with the resource transfer panel in the external airlock vestibule • Allows crew member's hand to more easily activate the QD's actuating ring • Resolves the difficulty encountered by the STS-110 crew demating the N2 QD during CEIT • Issue does not exist on the O2 side due to the difference in QD recess and cup diameter

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19112 Wirless Video System (WVS) Spread Spectrum Transceiver Upgrade FIRST FLIGHT				N/A *	N/A	* No Boeing certification impact – transceiver and associated certification is GFE responsibility • Original WVS system UHF operating frequency band of 400.2 MHz was limited by the FCC through July 2002. • Mod established upgraded GFE ORCA-XCVR-11 WVS transceivers with a UHF operating frequency band of 400.15 to 401 MHz, approved by the FCC for permanent utilization • Replaced the original ORCA-XCVR-01 • Boeing installation drawings and ICD updated to reflect the new GFE transceivers

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 17177 FRCS Attach Bolt Torque Class Revision FIRST FLIGHT			X	138-01-320101-058H	4/5/02 A	

- The FRCS is attached to the forward fuselage at 16 locations.
  - 6 locations in the X direction – 4 locations at the aft bulkhead and 2 locations at the forward bulkhead
  - 10 (5 RH / 5 LH) locations in the Z direction at the FRCS lower sill and the lower forward fuselage sill mating surfaces
- The 10 Z direction attachment is accomplished by using bolts that fasten through the FRCS into cone bolts in the lower forward fuselage
  - The cone bolts contain a threaded female feature in the cone that receives the mating bolt
- It was found during a recent inspection of OV-102 that 4 of the 10 cone bolts had less than the required installation torque
- Investigation revealed that the cone bolt installation torque is to class 1 and the FRCS mating bolt is to class 3
  - It was suspected that removal of the FRCS mating bolts at the higher installation torque than the cone bolt installation torque could cause the loss of torque on the cone bolts
- The design change was to change the installation torque of both the cone bolts and the FRCS installation bolts to a class 2 torque to preclude this condition
  - FRCS installation OMI to be revised to require cone bolt torque verification prior to module installation

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

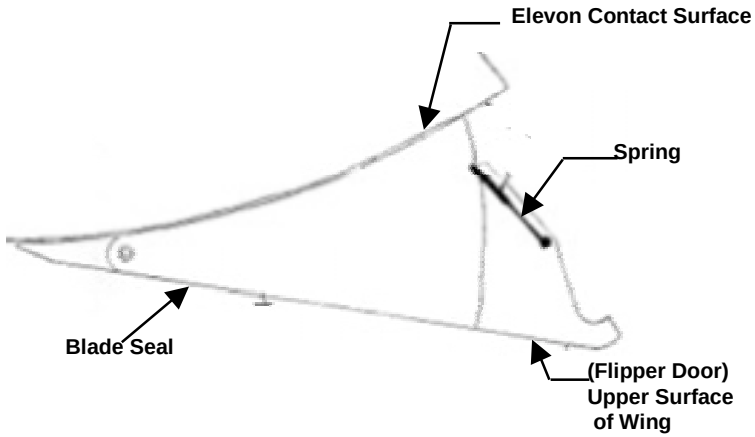
Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19555 Elevon Blade Seal Modification		X		20-07-198000-001Q	11/6/01A	

- The inboard elevon blade seals are not remaining seated against the elevon mating surface during the orbiter/et mating process.
- Prior to Orbiter/ET mate the elevons are fully dropped. When the orbiter goes vertical the elevons slowly drift to approximately null position. Because of this slow drifting the LH&RH blade seals don't slide down and seat against the elevon mating surface. The frequency of this problem is increasing.
- Design change replaces the old blade seal springs with new, stiffer springs
  - Increases the spring force and allows the blade seal to reseat itself



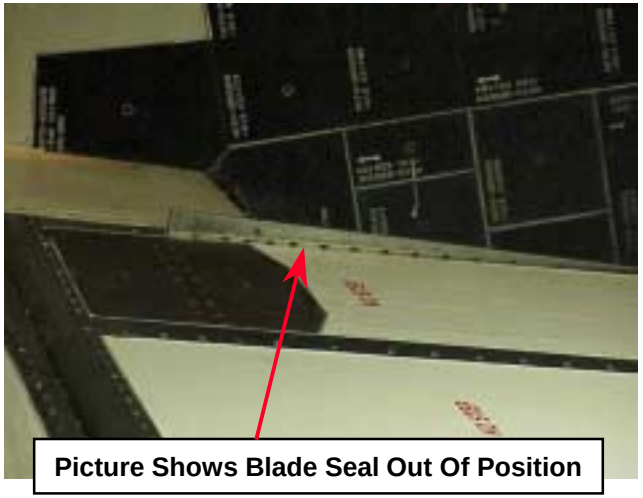
CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

MCR 19555 Elevon Blade Seal Modification

Blade Seal Housing and Blade Seal Spring



Picture Shows Blade Seal Out Of Position

Blade Seal and Spring

Blade Seal

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19033 ET Umbilical Plate Gap Delta P Transducer Mod Follow-On				N/A *	N/A	* Mod does not affect existing certification

Background:

- During the STS-108 flow, the ET Umbilical Plate Gap Delta P Transducer Mod was installed in OV-105
  - Modification installed a primary and redundant pressure transducers to measure purge pressure in the LH2 and LO2 ET/Orbiter disconnect plate gap.
  - Provides direct and accurate verification of positive plate gap cavity purge during cryo loading
  - Modification utilizes an unused LH2 and LO2 umbilical electrical monoball GSE port as a permanent plate gap pressure tap site
    - A new flexhose and hard line ports the cavity pressure from each umbilical plate gap to two redundant pressure transducers mounted on structure just aft of the umbilical area
    - New wiring installed to route pressure transducer signals to the LH and RH T-0 umbilicals and will be picked up by the LPS (ground measurement only).
  - Hardware was installed during the STS-108 processing flow, but was not be active as the corresponding ground side modifications were not completed.

STS-111 Mod Description:

- It was noticed during transducer installation last flow, that the K-Seal interface fitting on the transducers was not large enough to allow optimal K-seal capture and sealing
  - Tolerance buildup could result in an incorrect seal of the K-seal to the transducer body, resulting in leakage
  - A leak check was performed last flow to verify seal integrity
- Decision was made to modify the transducer seal configuration with an O-ring seal in place of the K-seal to provide a more optimal seal fit
- This will be the first flight use of the new umbilical pressure transducers on OV-105
- The exisitng drag on purge set up and its associated LCC will be used with the new instrumentation for 4 flights to collect and evaluate comparative data

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 18916 Upgraded EMU Dual Power Supply / Battery Charger	X			02-21-461-0032-0001F	10/13/99A	

- During 1996 OMI testing on Orbiter OV-105, the Extra-vehicular Mobility Unit (EMU) # 2 s/n 1016 feedwater shutoff solenoid valve was inadvertently energized, resulting in water being dumped in the airlock through the sublimator.
  - Data review revealed that the associated EMU Dual Power Supply and Battery Charger (DPS & BC) s/n 011 was providing output voltage spikes up to 23.9 volts (voltage level should not exceed 21 volts) while operating in the power supply mode and with the EMU fan operating in speed-control mode.
- Tests performed using combinations of EMU's and DPS & BC's (including those removed form OV-105) revealed that the EMU's loaded the DPS & BC with a greater load than the controlling specification and ICD requirements when the fan was operating in the speed-control mode.
  - Voltage transients on the DPS & BC output as high as 27.5 Vdc were found to be caused by rapid and large load removal (i.e. when EMU fan was in speed-control mode).
    - The cause of the problem is believed to be related to the DPS & BC abnormal response to the rapid load drop-offs with the higher than ICD specified loads.
  - The vehicle problem could only be duplicated when EMU s/n 1016 was powered by DPS & BC s/n 011.
- Additionally, the DPS&BC exhibits an audio noise factor, operating at a frequency that is audible and bothersome to the crew.
- To resolve both of these issues, the DPS&BC was redesigned and re-certified to meet the EMU load criteria and reduce the noise factor.
- Phase-in of the new DPS&BC approximately a year ago was delayed to resolve an issue with lower than expected vehicle instrumentation charge status readings during OMRS checkout of the first installation
  - Testing and analysis determined that the summation of tolerances within the vehicle instrumentation system could cause the low charge current status – no hardware issue
    - OMRS to be updated to reflect the expected charge status readings of the new DPS&BC
- Similar EMU feed water shutoff valve water leak experienced during STS-109
  - Potential cause of the anomaly is that the DPS&BC induced a voltage spike which caused the water valve to open
- Since the DPS&BC is a possible cause of the STS-109 anomaly and the new DPS&BC is now ready for implementation, it was decided that installation of the new unit would be prudent and eliminate a possible anomaly cause.

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 18755 Lightweight TSA Tool Retention Enhancement Mods **FIRST FLIGHT** Mission Kit MV0849A			X	01-25-660300-001B	4/1/02 A	• Tray modification to provide improved tool retention • Corrective action resulting from loss of tools during STS-97 EVA • Addition of diagrams depicting proper tool orientation • Crew request • Strapping/cushion configuration change to improve retention of the trays in the tool stowage assembly (TSA)
		X	X	01-25-849-660516-001F	3/27/02 A	
MCR 18755 Lightweight MAR Velcro Addition to Support WCS Compartment Curtain Mission Kit MV0859A				N/A	N/A	• Adds velcro to the LWMAR to attach the WCS compartment closeout curtain • Provides better closeout of the WCS compartment curtain when deployed • Requested by STS-110 crew during CEIT
MCR 19652 Modified Sleep Restraint Mission Kit MV0669A			X	03-25-000610-048C	1/24/02A	• Modifies the cumberbun, strap adjusters, arm holes, length and coating attach hooks per crew evaluation recommendations

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OV-105 STS-111 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			

MCR 18755
Sky Genie Installation Fastener Change
FIRST FLIGHT
Mission Kit MV0607A
			X	05-25-661607-001E	5-3-02 A	• Crushed sky genie pouch fastener installation grommets were observed prior to OV-105's previous mission
						  • Attributed to torque engagement of fully-threaded screws
						  • MR repairs have utilized over-sized washers
						• For STS-111, grommets have been repaired (returned to print) and installation fasteners changed to shoulder bolts to prevent grommet

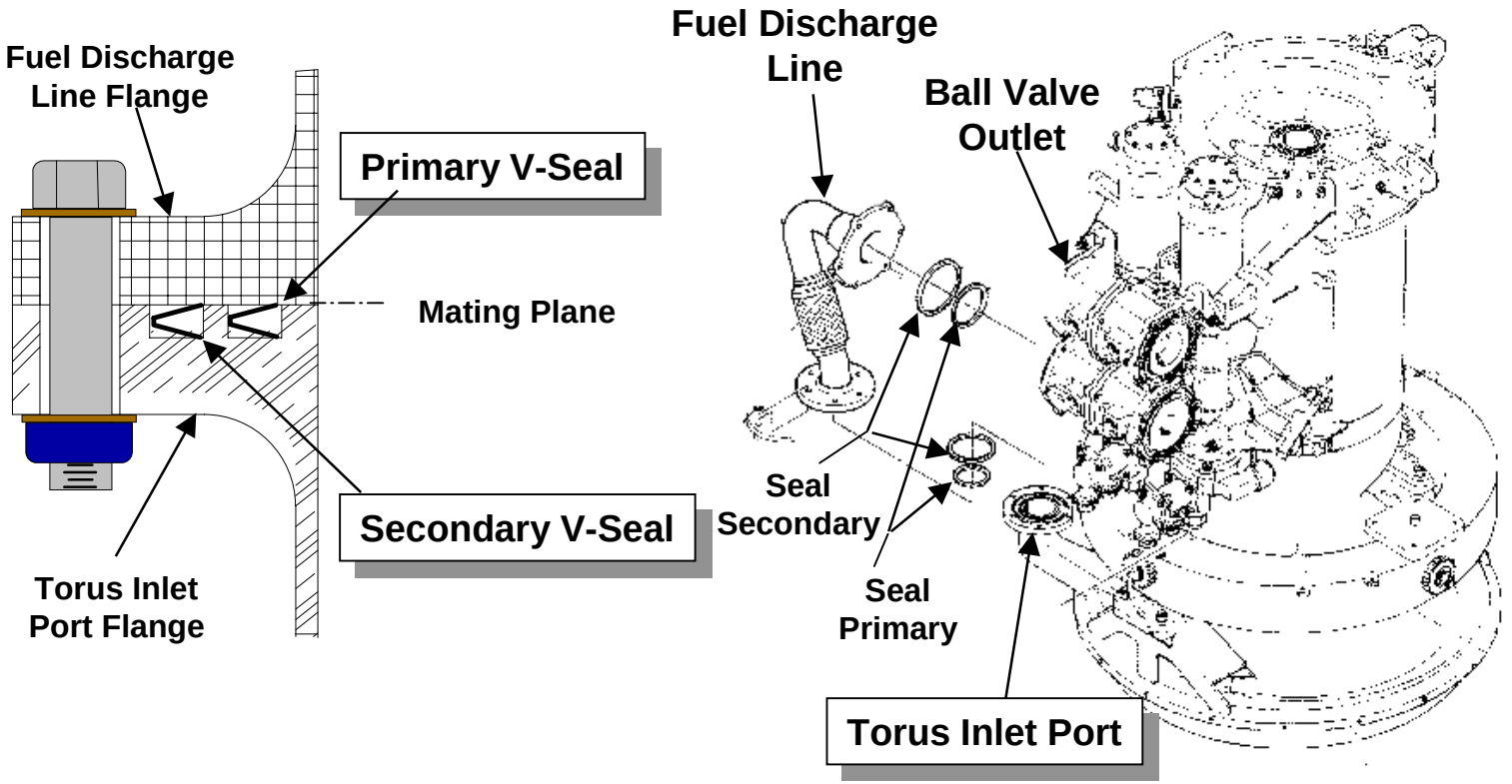
Main Hydraulic Pump Certification		X		05A-30-281-0029-0002H	3/26/02 A	• Certification deviation for DFL bolts used in main hydraulic pumps 2 & 3
OMS Engine Fuel Discharge Line Flange Bolt Cert Deviation	X	X		16-12-621-0001N	4/4/02 A	• Certification deviation for MR configuration of higher strength bolts at lowered torque level
Connector Saver Certification Deviation		X		05A-21-770000I	4/25/02 A	• Certification deviation documenting the OV-105 connector saver usage, rework and flight rationale
Vernier Thruster Certification Update **FIRST FLIGHT**		X		11-467-0029-0001T (Submitted 5/13/02)	TBD	• Cert update to cover a continuous 500 sec vernier firing to meet the 0.2 deg/sec maneuver rate control requirement during ISS mated attitude control and maneuvers

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/05-16-02

OMS Engine Fuel Discharge Line Flange Bolts



Fuel Discharge Line - Torus Inlet Port Mated Joint Section View

	Presenter:
	Organization/Date: Orbiter/05-16-02

MISSION KITS
BACKUP

STS-111 MISSION KIT MODIFICATION SUMMARY

Presenter:

Organization/Date:
Orbiter/05-16-02

54 Orbiter Mission Kits Are Manifested For STS-111:

- 4 STS-111 First Flight Mission Kit Related Modifications
  - MV0607A Modified Sky Genie Installation Fasteners
  - MV0669A Sleep Restraint Enhancements
  - MV0849A Lightweight Port TSA Cushion Tool Retention Enhancements
  - MV0857A Nitrogen Transfer Hose QD Release Ring Mod
- 3 Other STS-111 Mission Kit Related Modifications
  - MV0859A Velcro Addition to MAR to Facilitate Closure of WCS Compartment Curtain
  - MV0874A Modifications to Eliminate Interference with Bay 4 WVS Antennas and Active Longeron Latches
  - MV0886A Twelve Aft Fuselage Thrust Structure Micro-SGU Added
- Detail listing of all manifested orbiter mission equipment kits and associated mission equipment modifications follows

STS-111 MISSION KITS

Presenter:

Organization/Date:
Orbiter/05-16-02

MISSION KIT	TITLE	COMMENTS
MV0072P	PAYLOAD / GFE INSTLS	- OSVS TARGET INSTL
MV0073A	PAYLOAD SUPPORT EQUIPMENT	
MV0074A	FERRY FLIGHT KIT	
MV0076A	ORBITER DOCKING SYSTEM MECHANISM	
MV0082A	REMOTE MANIPULATOR SYSTEM (RMS)	- RMS INSTALLED THIS FLIGHT
MV0225A	COMMANDER & PILOT LW SEATS	
MV0226A	MISSION SPECIALISTS LW SEATS	
MV0412A	S-BAND FM SYSTEM	
MV0418A	MCDS	
MV0424A	CIRCUIT BREAKER COLOR CODE KIT	
MV0439A	OV-105 MADS SYSTEM	
MV0456A	ET UMBILICAL CAMERAS	- NEW RH UMBILICAL 35 MM STILL CAMERA - TWO OLD DESIGN LH UMBILICAL 16MM CAMERAS
MV0458A	EDO PALLET MISSION KIT PROVISIONS	
MV0465A	GN2 SUPPLY (NITROGEN TANKS)	- 6 GN2 TANKS
MV0485A	TACAN COOLING PROVISIONS	
MV0494A	GPS/INS DTO HARDWARE	- SIGI/CRV INSTALLED WITH MAGR-S

+ INDICATES MISSION KIT MOD

STS-111 MISSION KITS

Presenter:

Organization/Date:
Orbiter/05-16-02

MISSION KIT	TITLE	COMMENTS
MV0520A	PAYLOAD HEAT REJECTION (RADIATOR PANELS)	
MV0525A	PRSD SYSTEM TANK SET 4	
MV0529A	RENDEZVOUS AND DOCKING FLOODLIGHT	
MV0532A	PAYLOAD BAY LINER	- PARTIAL INSTL UNDER BAYS 1 & 2 LONGERON BRIDGES
MV0544A	PRSD TANK SET 3	
MV0545A	COMSEC EQUIPMENT	
MV0546A	PRSD TANK SET 3 & 4 THERMAL CONTROL BLANKET KIT	
MV0548A	BULKHEAD CLOSED CIRCUIT TV	
MV0549A	PAYLOAD BAY FLOODLIGHTS	
MV0566A	PRSD TANK SET 5	
MV0568A	PROVISIONS STOWAGE ASSY (PSA) - HANDHOLDS & PFR	
MV0571A	VTR / VIP CONTAINER / MUX PANEL	
MV0573A	AFT FUSELAGE BALLAST CONTAINERS	- NO BALLAST - CONTAINERS ONLY
MV0602A	LW STOWAGE LOCKERS	- MILSON FASTENER MOD
MV0603A	VOLUME A STOWAGE VOLUME B STOWAGE & ATTACH FITTINGS	

+ INDICATES MISSION KIT MOD

STS-111 MISSION KITS

Presenter:

Organization/Date:
Orbiter/05-16-02

MISSION KIT	TITLE	COMMENTS
MV0606A	AIRLOCK STOWAGE KIT SERVICING & COOLING UMBILICAL	
MV0607A	SKY GENIE	+ FIRST FLIGHT - SKY GENIE INSTL FASTENER MOD
MV0610A	HAND CONTROLLER INSTLN	
	LWT SEAT FLOOR STUDS	
MV0611A	WINDOW SHADES	
MV0612A	MIDDECK STRUCTURAL CLOSEOUT KIT	
MV0617A	EVA SLIDEWIRE	
MV0622A	PAYLOAD BAY FLAG	
MV0627A	LIOH CONTAINER	
	MULT. HEADSET ADAPTER PLATE ASSY	
	CPU ORIFICE SCREENS	
	ON-ORBIT STATION STOWAGE LOCKER	
MV0643A	MMU ORBITER PROVISIONS KIT	
MV0645A	LW MAR DEBRIS CLOSEOUT	
MV0647A	VOLUME D STOWAGE CONTAINER	
MV0651A	EMERGENCY EGRESS SLIDE	

+ INDICATES MISSION KIT MOD

STS-111 MISSION KITS

Presenter:

Organization/Date:
Orbiter/05-16-02

MISSION KIT	TITLE	COMMENTS
MV0653A	SORG	
MV0655A	AV BAY WIRE TRAY SCAMP ASSY	
MV0657A	CABLE TRAY	
MV0669A	SLEEPING BAGS & SLEEP RESTRAINTS	+ FIRST FLIGHT - SLEEP RESTRAINT ENHANCEMENTS
	LADDER	
	EMERGENCY EGRESS PLATFORM CUE CARD SUPPORT	
	WMC STOWAGE AND TRASH BAG	
	VOLUME 3B STOWAGE	
	INTERDECK LIGHT SHIELDS	
MV0712A	**NOTE: PAYLOAD INTEGRATION AFT FLIGHT DECK AVIONICS KIT**	
	GFE WIRELESS VIDEO SYSTEM CONTROL PANEL INSTALLED IN THE VIDEO PROCESSING UNIT (VPU)	
MV0827A	SPARE MCIU AND PDI	

+ INDICATES MISSION KIT MOD

STS-111 MISSION KITS

Presenter:

Organization/Date:
Orbiter/05-16-02

MISSION KIT	TITLE
MV0828A	EXTERNAL AIRLOCK & PROVISIONS
	TRAJECTORY CONTROL SENSOR
	STOWAGE PALLETS & BAGS
	- DOUBLE SMALL PORT FLOOR BAGS
	- DOUBLE SMALL STBD FLOOR BAGS
	- DOUBLE SMALL PORT CEILING BAGS
	- DOUBLE SMALL STBD CEILING BAGS
	- EXTERNAL AIRLOCK STOWAGE BAG
	EMERGENCY EGRESS NET
	MIDDECK HANDHOLDS
	FIRE EXTINGUISHER
	ON-ORBIT BUNGEE ATTACH FITTINGS
	CLOSEOUT NETTING INSTL
	Xo 576 HATCH STRAP INSTL
	ON-ORBIT / RETURN RETENTION STRAP

+ INDICATES MISSION KIT MOD

STS-111 MISSION KITS

Presenter:

Organization/Date:
Orbiter/05-16-02

MISSION KIT	TITLE	COMMENTS
MV0849A	LW TOOL STOWAGE ASSY (PORT)	+ FIRST FLIGHT - LWT PORT TSA CUSHION WITH TOOL RETENTION ENHANCEMENTS
MV0859A	LIGHTWEIGHT MAR & PROVISIONS INCLUDES LOCKERS & ATTACH FITTINGS	+ VELCRO ADDED TO FACILITATE CLOSURE OF WCS COMPARTMENT CURTAIN
MV0865A	CREWSEAT PROVISIONS SEATS 6, 7 & 8 RAIL ASSYS RSK HEADREST CUSHION FOOT SUPPORT INSTL	
MV0874A	WIRELESS VIDEO SYSTEM - PAYLOAD BAY ANTENNAS & ASSOCIATED COAX CABLES	+ MODIFICATIONS TO ELIMINATE INTERFERENCE WITH BAY 4 ACTIVE LATCHES & WVS ANTENNA
MV0886A	MICRO-WIS INSTRUMENTATION MPLM PAYLOAD BAY LATCH MICRO-TAU ACCELEROMETERS	+ 12 TH MICRO-SGU INSTALLED THIS FLOW
	AFT FUSELAGE ENGINE STRUT MICRO-SGU STRAIN GAUGES	- MICRO-SGU GROUPS 4 & 5 COMPLETED THIS FLOW

+ INDICATES MISSION KIT MOD

	Presenter:
	Organization/Date: Orbiter/05-16-02

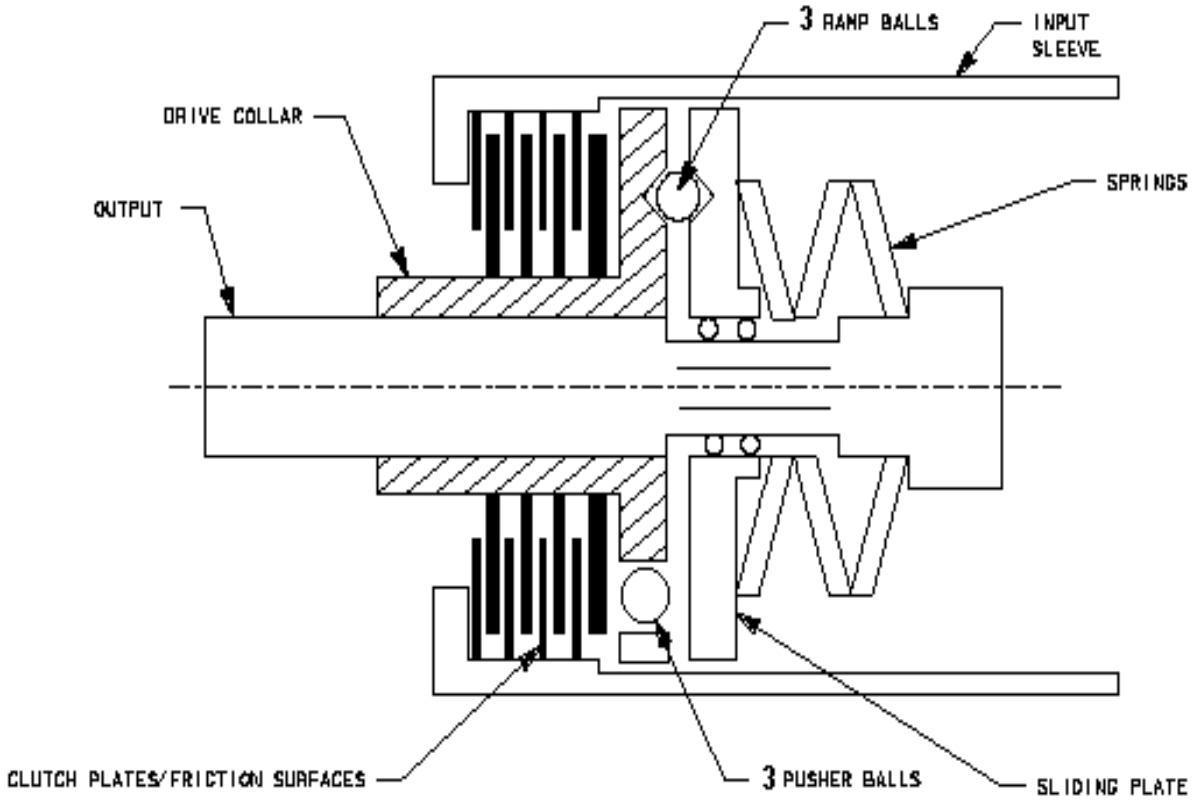
SPECIAL TOPICS BACKUP

ET DOOR DRIVE PDU TORQUE LIMITER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

Simplified Torque Limiter Schematic



ET DOOR DRIVE PDU TORQUE LIMITER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

PDU Stall Max Torque Test Results

PDU S/N	TU112	TU114	TU102	TU111	TU109	TU113
Location	OV-105 LH	OV-105 RH	OV-105 RH (replaced TU114)	OV-102 RH	OV-102 LH	Spare
Current Stall Torque (in.-lbs.)	7,200 - 8,400	6,800	8,800 - 9,600	8,300 - 8,800	7,800 - 8,200	7,600 - 8,400
Original ATP Stall Torque (in.-lbs.)	9,800 - 10,800	10,400 - 11,000	10,000 - 11,600	11,000 - 11,600	11,800 - 12,400	10,400 - 11,000
Original ATP Date	Jan-97	Jan-97	May-00	May-00	Jul-98	Jul-98
Estimated # of Cycles	68	115	10	16	34	0

ET DOOR DRIVE PDU TORQUE LIMITER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

15600-2 TU 114 SHIM TEST RESULTS

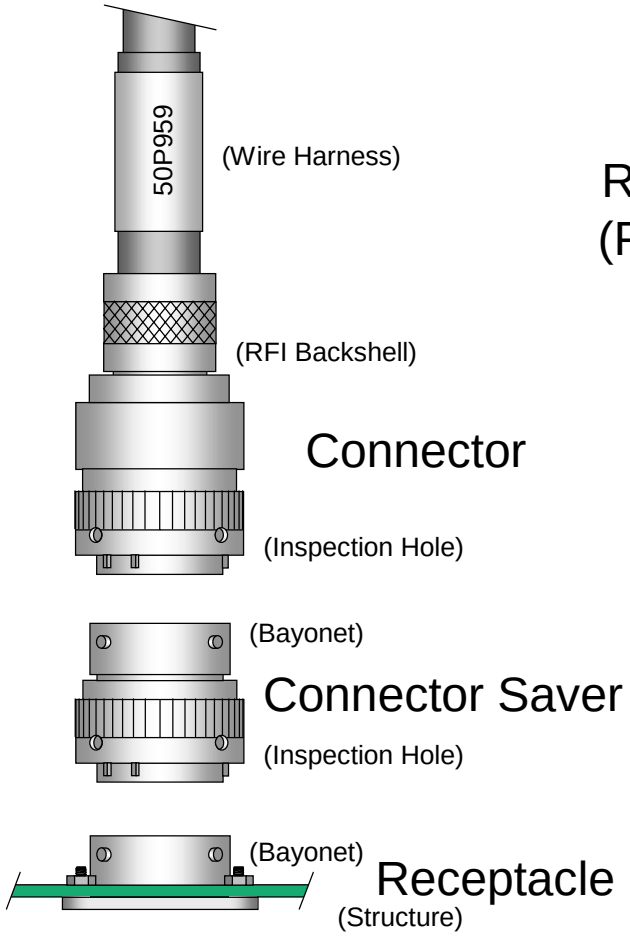
Mean Torque Limiter Slip Torque	Mean Actuator Slip Torque	Plate Gap After Assy.	Plate Gap After Test	Mean Belleville Stack Height after Assy.	Mean Belleville Stack Height after Test
Baseline w/o Shim					
700 cw, 690 ccw		.004-.006		0.349	
	12,100 cw, 12,100 ccw		.004-.006		0.349
Added .002 Shim					
725 cw, 700 ccw		.0015-.0025		0.349	
	12,300 cw, 12,500 ccw		.002-.004		0.349
Added .004 Total Shim Thickness					
730 cw, 715 ccw		0-.0015		0.349	
	12,400 cw, 12,400 ccw		.0005-.0025		0.348
Added .006 Total Shim Thickness					
710 cw, 700 ccw		0-.001		0.349	
	12,000 cw, 12,400 ccw		0-.001		0.348
Added .008 Total Shim Thickness					
420 cw, 463 ccw		0		0.347	
	8,400 cw, 8,300 ccw		0		0.347
Added .010 Total Shim Thickness					
65 cw, 65 ccw		0		0.347	
	1,600 cw, 1,600 ccw		0		0.351

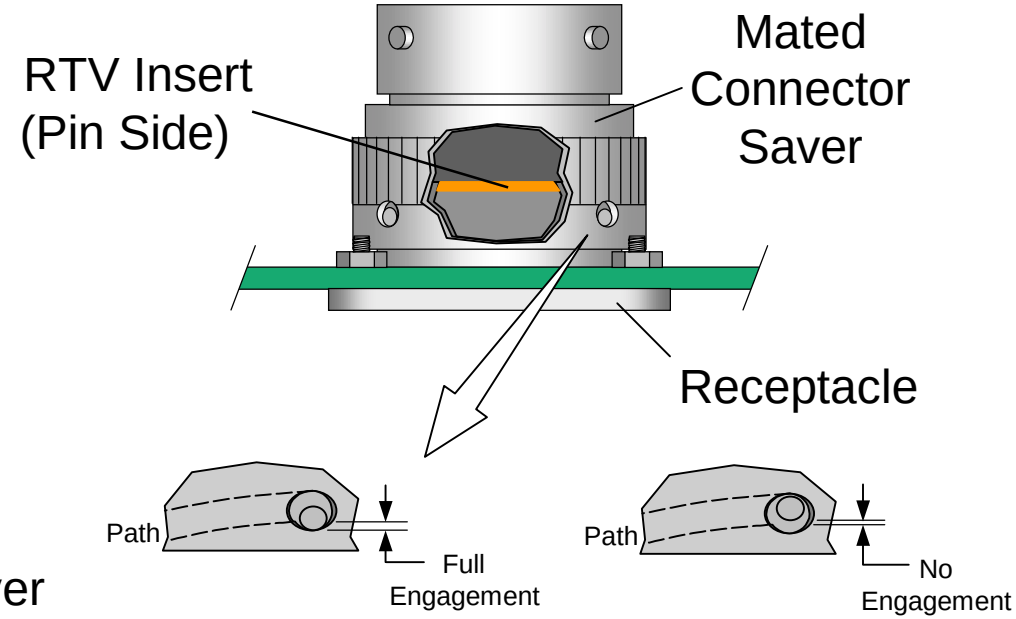
CONNECTOR SAVER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

Monoball Harness Connector Saver



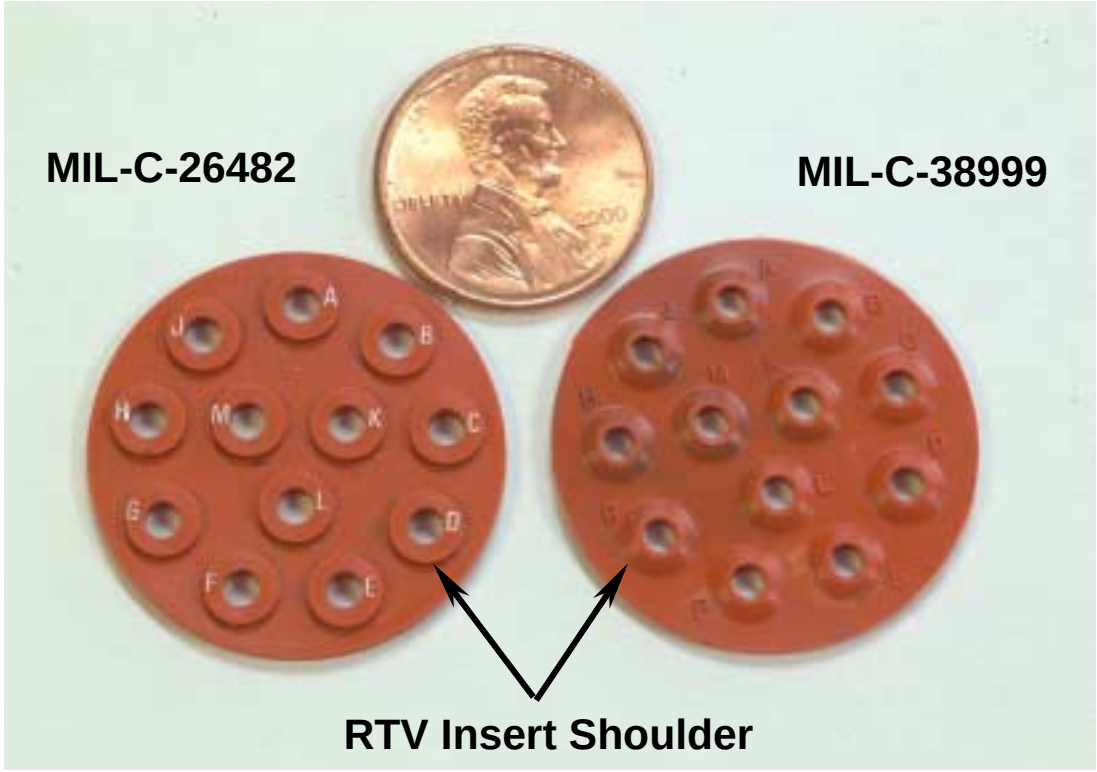


Proper Mate

Bayonet Location After Axial Load Applied

CONNECTOR SAVER ANOMALY	Presenter:
	Organization/Date: Orbiter/05-16-02

RTV Pin-Side Insert

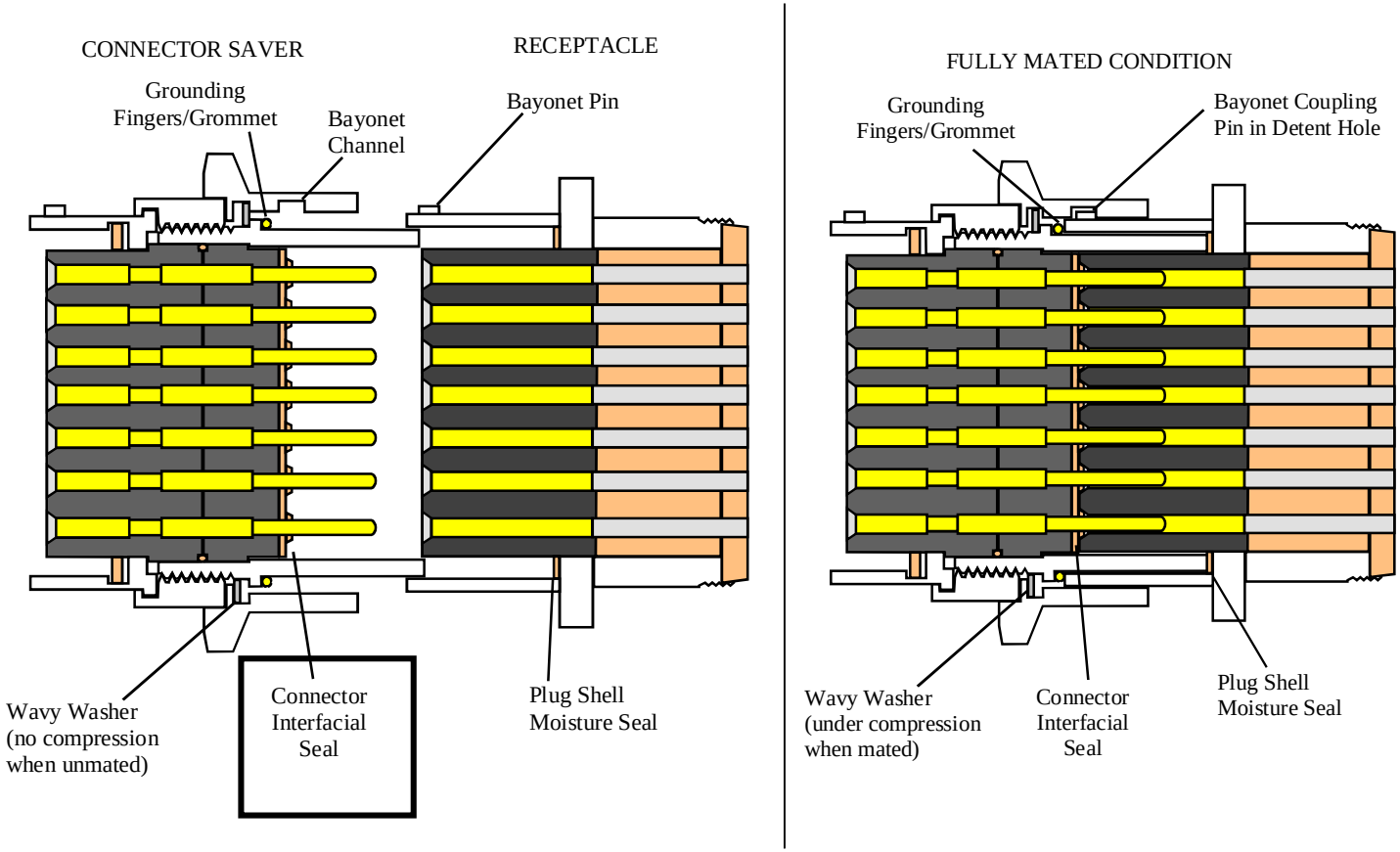


CONNECTOR SAVER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

Connector Saver / Mating Connector Cross-Section

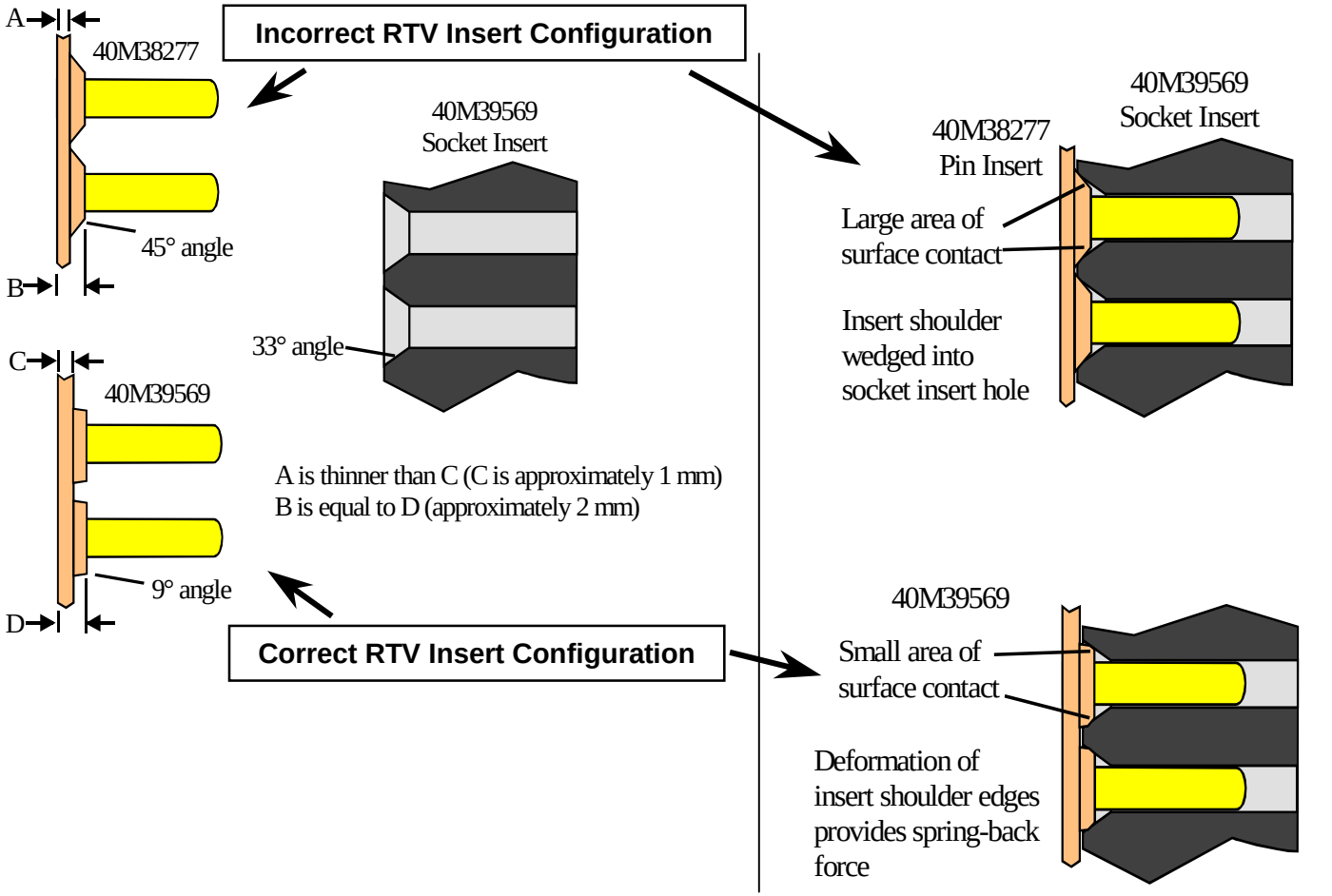


CONNECTOR SAVER ANOMALY

Presenter:

Organization/Date:
Orbiter/05-16-02

Detailed Cross-Section of the Connector Saver Interface



	Presenter:
	Organization/Date: Orbiter/05-16-02

OMS/RCS MR SUMMARY BACKUP

OMS/RCS MR SUMMARY

Presenter:

Organization/Date:
Orbiter/05-16-02

PR Number	Part Name	Part Number	Serial	Date
LP04-25-0944	**OMS Engine**	**MC621-0009-4005**	**105**	**04/05/02**

OMS engine fuel discharge line flange bolts overtorqued. Earlier upgrade to a v-seal resulted in bolt torque increase from 50-60 in-lb to 80-90 in-lb. Torque exceeded the prescribed torque limit for this bolt. R&R'd bolts with bolts of higher strength, MD111-4020-03XX (XX based on stack buildup). Bolt installation covered by Certification Approval Request 16-12-621-0001N.

RP01-32-1232	**OMS Engine**	**MC621-0009-4007**	**109**	**04/05/02**

OMS engine fuel discharge line flange bolts overtorqued. Earlier upgrade to a v-seal resulted in bolt torque increase from 50-60 in-lb to 80-90 in-lb. Torque exceeded the prescribed torque limit for this bolt. R&R'd bolts with bolts of higher strength, MD111-4020-03XX (XX based on stack buildup). Bolt installation covered by Certification Approval Request 16-12-621-0001N.